The Treasury Does Monetary Policy*

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Abstract

Debt management decisions have macroeconomic effects comparable to monetary policy. Using high-frequency movements in Treasury futures around issuance announcements, we identify a *Treasury policy shock*—an unanticipated change in public debt supply across maturities. A shock that raises the five-year Treasury yield increases corporate borrowing rates, tightens financial conditions, and lowers industrial production. These effects mirror those of conventional monetary policy shocks. In this sense, the Treasury does monetary policy. Unlike monetary policy shocks, our shock has minimal effects on short-term rates. This pattern arises because the Federal Reserve sterilizes short-term issuance, while only partially offsetting issuance at longer maturities.

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1. Introduction

Treasury debt management is widely viewed as a policy designed to finance government spending at the lowest possible cost but largely neutral for macroeconomic outcomes. In contrast, monetary policy is regarded as the key tool for stabilizing the business cycle. This paper shows that Treasury debt issuance decisions can have macroeconomic effects remarkably similar to those of conventional monetary policy. We document that changes in debt supply systematically affect financial conditions, corporate borrowing costs, prices and real economic activity. Taken together, our findings suggest that debt management has the potential to serve as a powerful macroeconomic stabilization tool.

We identify exogenous variation in Treasury debt supply by exploiting high-frequency movements in Treasury futures prices around Treasury issuance announcements. Such announcements contain detailed information on the size and the maturity composition of forthcoming debt issuance. The shock—which we label *Treasury policy shock*—captures unexpected changes in issuance at both the short and the long end of the maturity spectrum. We use this shock within a standard local projection framework to estimate the financial and macroeconomic effects of Treasury debt issuance decisions.

These effects are immediate and quantitatively meaningful. An unexpected increase in debt supply leads to a sharp rise in long-term Treasury yields. Quantitatively, an increase of 10 basis points in the five-year yield leads to a rise of 7.5 to 10 basis points in long-term yields. By contrast, short-term rates barely move. More than half of the increase in long-term yields reflects higher term premia rather than revisions to expected short-term rates. The rise in Treasury yields passes through almost one-for-one to corporate borrowing rates. Hence, financial conditions tighten: excess bond premium and the Baa-Aaa spread rise.

These interest rate effects have large real consequences. A positive Treasury policy shock induces a persistent decline in industrial production, with a trough of about 1.8 percent below trend one year after the shock. The contraction is driven primarily by a sharp and sustained decline in investment. Consumption expenditure and prices mildly decline. Taken together, these findings imply that the transmission of a Treasury policy shock expanding debt issuance is similar to a contractionary monetary policy shock.

This resemblance is not merely qualitative. A direct comparison between Treasury and monetary policy shocks shows remarkably similar paths for output, consumption, investment, prices and long-term rates. The key difference is that a conventional monetary policy shock raises short-term rates, while a Treasury policy shock has little impact at the short end of the curve.

To provide further evidence on the equivalence between Treasury and monetary policy shocks, we augment a standard medium-scale DSGE model with a financial block featuring downward-sloping demand for long-term debt. The latter is generated by the presence of arbitrageurs with mean-variance preferences that require a premium to hold duration risk. Despite generating different impact responses at the short end of the yield curve, the model shows that the two shocks produce remarkably similar macroeconomic dynamics, as both operate through an increase in long-term interest rates.

The absence of a response in short-term rates to a Treasury policy shock suggests that the Fed sterilizes the liquidity implications of Treasury issuance. It does so to maintain tight control of its operating target. Consistent with this interpretation, the policy rate remains unchanged, while the quantity of short-term Treasury debt held by the Fed rises. By contrast, the rise in long-term yields suggests that the Fed does not fully sterilize the effects of the shock at longer maturities. We provide narrative evidence from FOMC documents to support our interpretation of how the Fed responds to Treasury policy shocks. Importantly, the Fed's liquidity injections are not mechanically matched to sales of Treasury securities: the quantity of reserves supplied reflects the amount needed to preserve the operating target, while the composition of the Fed's portfolio—biased toward short-term securities—only partially offsets long-term Treasury issuance.

Our findings suggest that debt management can serve as an important macroeconomic stabilization tool. By influencing long-term interest rates through its issuance decisions, the Treasury can generate financial and macroeconomic effects that closely resemble those of conventional monetary policy. In this sense, our results are consistent with Milton Friedman's observation that

> *"... open market operations and debt management are different names for the same monetary tool, wielded in one case by the Federal Reserve System, in the other, by the Treasury."*
>
> — Milton Friedman, *A Program for Monetary Stability* (1959)

Taken together, our findings suggest that control over financial conditions may not rest exclusively with the central bank. If the Treasury can influence long-term interest rates through the quantity of debt it issues, this raises the possibility that an independent central bank alone may not be sufficient to maintain price stability. More broadly, our results suggest that the interaction between debt management and monetary policy is important for macroeconomic stabilization.

Related literature and contribution. We connect to a growing empirical literature that studies the financial and macroeconomic effects of Treasury debt issuance. Using high-frequency movements around Treasury auction announcements, recent papers identify debt supply shocks and examine their effects on both financial markets (Phillot, 2025; Hartley and Rigon, 2024) and the broader economy (Houtz, 2025; Bi, Phillot, and Zubairy, 2025; Mustafi, 2025). This literature shows that unexpected increases in debt supply tighten financial conditions and have contractionary effects on economic activity.[1]

Our paper contributes to this literature along three dimensions. First, we emphasize the distinction between short-term debt—Treasury bills with maturities of one year or less, which are money-like—and longer-term debt, which carries duration risk. While this distinction is central to the finance literature (Greenwood et al., 2014) and features prominently in recent policy debates (Miran and Roubini, 2024), it has received little attention in the empirical macroeconomic literature. We show that increases in both short- and long-term debt issuance leave short-term interest rates largely unchanged, while causing a pronounced rise in longer-term yields. Second, we document a striking similarity between the transmission mechanism and aggregate effects of Treasury policy shocks and those of conventional monetary policy shocks. Third, we study the Federal Reserve's response to Treasury issuance and show that Treasury policy systematically influences both the size and composition of the Fed's balance sheet.

We also relate our work to a theoretical literature emphasizing the equivalence between the effects of non-monetary policies and those of conventional monetary policy. Correia et al. (2013) show that, in a standard New Keynesian model, distortionary taxes can replicate the accommodative effects of negative interest rates. Similarly, Wolf (2025) shows that, in an economy with non-Ricardian households and lump-sum transfers, fiscal policy can reproduce the aggregate effects of monetary policy. Our paper contributes to this literature by highlighting a different form of equivalence: that between debt management decisions and conventional monetary policy.

Our paper also relates to the literature on quantitative easing and central bank balance sheet policies. A large body of work studies whether and how central bank asset purchases affect financial conditions and macroeconomic outcomes (Krishnamurthy and Vissing-Jorgensen (2011), Gagnon et al. (2011), D'Amico et al. (2012), Rogers, Scotti, and Wright (2018), Bauer and Rudebusch (2018), Christensen and Krogstrup (2019), Swanson (2021); Swanson (2023), and Kim, Laubach, and Wei (2023), among others). More recently,

[1] Bi, Phillot, and Zubairy (2025) and Mustafi (2025) decompose high-frequency movements of Treasury futures around auction announcements into a debt level and a maturity shock. In this paper, we focus solely on the level dimension.

several papers have used Treasury auctions to construct QE-like shocks and study the financial and macroeconomic effects of balance sheet policies (Droste, Gorodnichenko, and Ray, 2024; Chatterjee, 2026).

Relative to this literature, we make two contributions. First, we document a strong pass-through from Treasury yields to corporate borrowing rates, consistent with more recent estimates and at odds with earlier evidence. Second, we study how the Federal Reserve adjusts its balance sheet in response to Treasury issuance. We argue that this response helps explain why Treasury issuance has markedly different effects on interest rates across maturities.

Finally, our analysis connects to the broader literature on fiscal–monetary interactions (Sargent, Wallace, et al. (1981); Leeper (1991); Bianchi, Faccini, and Melosi (2023); Angeletos, Lian, and Wolf (2025), among others). While this literature has traditionally focused on taxes and government spending on the fiscal side and interest rate setting on the monetary side, we instead emphasize debt management as a core fiscal instrument and the central bank's balance sheet as a key monetary policy tool. In doing so, we provide new empirical evidence on a channel that was already highlighted by Friedman (1959).

Outline. Section 2 describes the institutional context and our identification strategy. Section 3 examines both the financial and macroeconomic effects. After presenting the transmission mechanism of Treasury policy shocks, we compare it to standard monetary policy in Section 4. We provide both time series evidence and a medium-scale DSGE model showing that the two shocks have remarkably similar macroeconomic effects. Finally, in Section 5, we study the response of the Fed. We first present empirical evidence on the average response of the Fed over the sample period. We then supplement this with anecdotal evidence from FOMC documents to offer a rationale for why the Fed reacts in this way. Section 6 concludes.

2. Identification

The Treasury announces policy decisions in a regular and predictable manner (Phillot, 2025). Market participants closely monitor these decisions, and the announcements can lead to significant market reactions. Naturally, this setting lends itself to a high-frequency identification strategy—an approach already widely used in the monetary policy literature (Gertler and Karadi, 2015; Bauer and Swanson, 2023). The idea is to construct a series of surprises computed in a narrow window around Treasury announcements that capture any unexpected news about Treasury policy. Assuming demand is fixed in that narrow window, we can isolate exogenous movements in debt supply. In this way, we obtain a series of Treasury policy shocks that can be used to study their financial and macroeconomic effects. Before discussing the identification procedure, we provide some background on how Treasury policy works in practice and on Treasury futures markets.

2.1. Institutional background

The U.S. Treasury is responsible for debt management policy—that is, it determines how the federal government borrows to finance public spending. Decisions on taxes and expenditures are made by the U.S. Congress through negotiations conducted throughout the year, culminating in the budget resolution. This resolution must be passed by October 1, the start of the fiscal year, and contains estimates of outlays, tax revenues, and the resulting overall deficit for the upcoming year (Wiegand, 2025).

Given these aggregate borrowing needs, Treasury debt managers decide how to allocate issuance over time—namely, across auctions—and how to distribute borrowing across maturities. In other words, "debt management necessarily involves judgments about the size and duration of the federal government's borrowing needs." By choosing the size and composition of public debt issuance ahead of each auction, the Treasury aims to "minimize borrowing costs over many years and interest rate cycles" (see the Quarterly Refunding Statement of October 31, 2001).

Particularly relevant for our setting, the Treasury announces policy in a manner similar to how the Federal Open Market Committee (FOMC) announces monetary policy decisions. Once a quarter—typically on Wednesday at 8:30 A.M. (Eastern Time)—it releases a policy statement called the Quarterly Refunding Statement (QRS), followed by a press conference. These announcements provide news about an upcoming auction that will take place one week later, along with information about the Treasury's borrowing plans for the current quarter (Figure A1). In addition to these announcements, the Treasury releases intermediate statements on its website over the course of the quarter containing information about upcoming auctions. These documents specify the auction date, the maturity that will be offered, and the overall size of the planned issuance (Figure A2). Importantly for our purposes, both types of announcements contain relevant information about the size of debt issuance at different maturities. Moreover, these announcements occur regularly and are scheduled in advance.

To capture any unexpected news about Treasury policy, we need to measure investors' expectations about the likely path of Treasury prices immediately before the announcement. For this purpose, we use Treasury futures prices. Treasury futures have been traded on the Chicago Board of Trade since 1977. Importantly, these contracts are quoted in terms of prices (rather than yields) and do not bear coupon payments. For this reason, they represent an ideal proxy for investors' expectations about near-term future Treasury yields.

For our purposes, it is crucial that Treasury policy announcements are closely watched by market participants. By examining high-frequency changes in Treasury futures prices, we can assess whether investors react to news released by the Treasury. Figure A3 illustrates market reaction following the May 6, 2020 QRS announcement. The solid lines depict the inverse change in Treasury futures prices, measured in percentage points relative to one hour before the release. In the announcement, the Treasury stated that it planned "to increase its long-term issuance". Consistent with this guidance, Treasury yields rose sharply immediately following the release.

2.2. Construction of the Treasury policy shock

To construct a Treasury policy shock series, we obtain minute-by-minute data on the prices of futures of 2-, 5-, 10-, and 30-year Treasuries from Refinitiv Datascope. These are front-month contract futures, that is they capture short-term expectations about the price (and therefore the yield) of these underlying assets. We select these four futures since they are a parsimonious representation of the yield curve, and due to data availability. In particular, we have access to a long time series going from February 4, 1998, to June 3, 2025. We choose a 60-minute window around the announcement and compute the high-frequency price change in the four futures. More specifically, for any given future price P_t^f, we compute the high-frequency change as

$$\Delta P^f_{t+h} = 100 * \left(\log(P^f_{t+h}) - \log(P^f_{t-h}) \right) \tag{1}$$

where t is the time of the announcement, and h denotes a 30-minute window. To interpret the high-frequency change as a change in Treasury yields, we multiply ΔP^f_{t+h} by minus one. As explained above, Treasury policy is about choosing the size of debt issuance along the entire maturity spectrum. Given that we obtain the high-frequency changes in four different futures, we summarize the informational content of such announcements via principal component analysis. In particular, given the matrix of high-frequency changes X of dimension $T \times n$, we can write

$$X = F\Lambda + \eta \tag{2}$$

where F is a $T \times k$ matrix of factors and Λ is $k \times n$ matrix of factor loadings. In our case, $n = k = 4$. In Table 1, we show the results of this decomposition.

Table 1: PCA Results

Panel A: Variance Explained				
	F1	F2	F3	F4
Variance Share	0.8144	0.1288	0.0393	0.0174

Panel B: Loadings				
	F1	F2	F3	F4
2-year	0.4544	0.7531	0.4681	-0.0846
5-year	0.5277	0.1344	-0.6281	0.5559
10-year	0.5312	-0.2321	-0.2805	-0.7651
30-year	0.4826	-0.6007	0.5547	0.3139

Panel A shows the share of variance explained by each component. The first principal component explains a large share of the variance of the matrix X. The second, third, and fourth principal components explain 13, 4, and 2% of the variance, respectively. We focus on the first principal component as a way to summarize the informational content of Treasury policy announcements. Panel B shows the loadings associated with the four principal components. Focusing on the first, loadings are constant across the maturity spectrum. As we will show later, this shock corresponds to unexpected news about a relatively persistent increase in public debt issuance. Importantly, this increase takes place both at the short and at the long end of the maturity spectrum.[2]

Announcements. We collect dates and timestamps for both Quarterly Refunding Statements and intermediate announcements from July 21, 1998, to June 3, 2025. We consider intermediate announcements about coupon-bearing Treasuries, that is of maturity of 2, 3, 5, 7, 10, 20, or 30 years. Our dataset includes a total of 108 Quarterly Refunding Statements and 544 intermediate announcements. However, sometimes other important macroeconomic announcements occur around the same time as the Treasury policy announcements. For example, in five cases, the first release for U.S. GDP happens at the same time as the Treasury Quarterly Refunding Statement. Including such Treasury an-

[2]While we work on the first principal component, we also study the second. The latter loads with opposite signs at the short and the long end of the curve (0.75 at two years against -0.60 at thirty years), and corresponds to the slope factor of the yield curve. However, by inspecting the impulse responses of both quantity and prices, we do not obtain a clean interpretation: the maturity structure contracts while long-term yields rise. Results are reported in Appendix A.5.

nouncements in our analysis would run the risk that the high-frequency change in futures prices reflects an unexpected news stemming from the other announcements, and not from Treasury policy. For this reason, we exclude days in which another important macroeconomic announcement is released within one hour before and 30 minutes after the time of the Treasury policy announcement (see Table A1 for a list of announcements that we consider). We retain 94 QRS and 503 intermediate announcements, a total of 597 announcements.

2.3. Diagnostics of the shock

The daily series is shown in Figure 1. In what follows, we first provide narrative evidence to describe our series. We then perform diagnostic checks, both at the daily and the monthly frequency, to make sure our shock series is consistent with the requirements of an exogenous shock, as outlined by Ramey (2016).

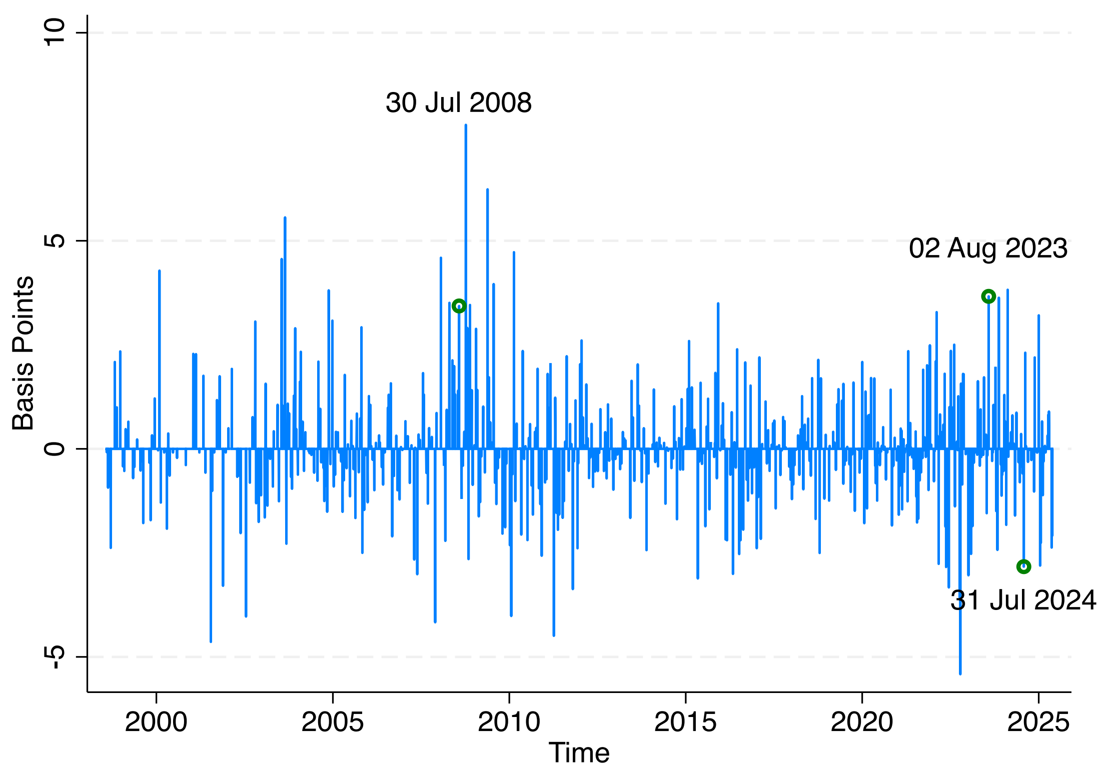

Figure 1: Treasury policy shock series

Note: this figure shows the Treasury policy shock series expressed in basis point changes in the five-year rate.

Narrative evidence. The time-series behavior of our high-frequency Treasury policy shock lines up closely with salient episodes of changes in Treasury debt management policy. We focus in particular on QRS announcements, which are highly informative and offer clear narrative statements of Treasury's policy intentions. Consistent with this interpretation, sizable movements in our series occur precisely on days when Treasury communicated adjustments to its issuance strategy. For instance, in the July 30, 2008 refunding announcement, Treasury explicitly acknowledged an increase in Treasury's marketable borrowing needs and signaled that it was "considering a second reopening of the 10-year note" and "moving to quarterly new issue 30-year bond auctions". On August 2, 2023, Treasury announced that it would "gradually increase coupon auction sizes beginning with the August to October 2023 quarter", noting that "further gradual increases will likely be necessary in future quarters". Conversely, on July 31, 2024, Treasury delivered a dovish pivot, stating that it "did not anticipate needing to increase nominal coupon or FRN auction sizes for at least the next several quarters". These episodes correspond to some of the most pronounced movements in our shock series, reinforcing the view that the measure reliably captures unexpected revisions in Treasury financing policy.

Diagnostic checks. Before providing evidence that our shock series is valid, we need to aggregate the shocks at the monthly frequency. To deal with temporal aggregation bias (Kilian, 2024), we follow Gertler and Karadi (2015) and weigh each surprise based on the number of remaining days until the end of the month.

Endowed with both the daily and the monthly shock series, we can perform several diagnostic checks. First, our shock series should not be autocorrelated. In Figures A4 and A5, we plot the autocorrelation function. For the daily series, we see the series does not exhibit significant autocorrelation, except at lags 10 and 14. For the monthly series, by construction the series will show autocorrelation in the first lag.[3] Our shock should also not be correlated with other identified macroeconomic shocks of interest. Table A2 verifies that this is indeed the case.

It is also important to check that our shock series is not forecastable by lags of financial and macroeconomic variables. We run a series of Granger causality tests, both at the daily and at the monthly level, and find no evidence of forecastability of the series (Table A3). Finally, an important concern in the monetary policy literature is whether the monetary policy surprises are predicted by news that is released prior to the FOMC announcements

[3]This is a mechanical consequence of the aggregation method we choose. Below, in our baseline specification for both daily and monthly regressions, we will control for lags of the shocks. However, controlling or not for the lags of the shocks does not make a notable difference both in terms of point estimates and confidence bands.

(Bauer and Swanson, 2023). Using the same set of news as the one used in that literature, in Table A4 we show that our surprises are not significantly predicted by news available before the actual Treasury policy announcements. Across the three sample periods analyzed, the R^2 is 3% or lower. Overall, these checks provide evidence on the validity of our shock series.

3. Financial and macroeconomic effects

This section documents the financial and macroeconomic effects of Treasury policy shocks and clarifies the mechanism through which they operate. We show three main results. First, Treasury policy announcements convey news about future debt issuance that translates into systematic changes in the supply of public debt. Second, these shocks have immediate and economically meaningful effects on financial markets: they raise long-term Treasury yields, with little effect on short-term rates, and transmit almost one-for-one to corporate rates. Third, the resulting tightening in financial conditions leads to large and persistent real effects, primarily through a contraction in investment. Together, these findings establish Treasury debt management as a powerful driver of financial conditions and aggregate activity.

To estimate the effects of the Treasury policy shock, we employ both daily and monthly local projections (Jordà, 2005). For each horizon h, we estimate the following regression:

$$y_{t+h} - y_{t-1} = \alpha_h + \beta_h shock_t + \gamma_h \mathbf{X}_{t-p} + \varepsilon_{t+h}, \tag{3}$$

where y denotes a financial or macroeconomic outcome of interest and *shock* is our measure of Treasury policy shock. In the daily specification, $\mathbf{X}_{t-p}$ includes five lags of *shock* and y, as well as year and day-of-the-week fixed effects. In the monthly specification, $\mathbf{X}_{t-p}$ includes twelve lags of *shock* and y, industrial production, CPI, and the excess bond premium, capturing pre-existing macroeconomic and financial conditions. To control for the zero lower bound and for the Covid period, we also include two deterministic controls.[4]

Our baseline sample runs from July 21, 2003, to February 28, 2025. This starting point reflects the availability of Federal Reserve balance sheet data, which we later use to study

[4]Specifically, we define the zero lower bound as periods where the federal funds rate is at or below 0.5 (Miyamoto, Nguyen, and Sergeyev, 2024). This results in the ZLB corresponding to the periods 2008:M11 to 2016:M11 and 2020:M4 to 2022:M4. Further, we define the Covid period from 2020:M2 to 2020:M12. Mid-December is when the first anti-Covid vaccines were distributed in the United States. Results are largely unchanged if we exclude these deterministic controls, as we show in the Appendix.

the Fed's response to Treasury policy. All impulse responses are scaled to correspond to a 10 basis point increase in the five-year Treasury yield on impact.

Because our specification includes lags of the dependent variable, it corresponds to the "lag-augmented" local projection approach of Montiel Olea and Plagborg-Møller (2021). Accordingly, we report heteroskedasticity-robust standard errors. As a robustness check, we verify that the results are unchanged when using Newey–West standard errors.

3.1. Understanding the shock: Debt response

We begin by clarifying what the Treasury policy shock represents in terms of actual debt issuance. Although the shock is identified from high-frequency movements in Treasury futures prices, its economic interpretation ultimately depends on whether it systematically predicts subsequent changes in the supply of public debt. This subsection shows that it does: Treasury announcements contain information about future issuance decisions that materialize in observable changes in the supply of debt.

We further clarify what is—and what is *not*—captured by the high-frequency variation in Treasury futures prices. Our shock predicts only mild and short-lived statistically significant movements in the weighted average maturity of debt. This suggests that the informational content of these announcements primarily concerns the size of individual auctions rather than large changes in the maturity composition of debt issuance. In addition, as we show below, our shock does not predict movements in government spending. The Treasury takes government expenditures and tax revenues as given when making borrowing decisions. It follows that our shock measure is conceptually distinct from traditional measures of "fiscal shocks" (Ramey, 2016).

In our view, two main factors account for the high-frequency variation in Treasury futures prices following these announcements. First, the Treasury has discretion over the *total* amount of borrowing conducted at any given auction. In other words, it can choose the *timing* of borrowing.[5] Second, the Treasury determines the desired size of the Treasury General Account (TGA)—the cash account it holds at the Federal Reserve.

Figure 2 displays the response of total U.S. public debt in the days following the shock. Debt issuance begins to rise about six days after the announcement, consistent with the institutional structure of Treasury policy. Both Quarterly Refunding Statements and intermediate announcements specify quantities to be auctioned in the following week, im-

[5] In a speech delivered on November 19, 1964, Robert Roosa, then Under Secretary of the Treasury for Monetary Affairs, stated: "The Treasury has complete initiative with respect to timing and amounts. Instead of being bound to act on a maturity date established many years earlier, the Treasury can choose when to enter the market, in the light of prevailing market conditions—accomplishing more, disturbing less" (Garbade, 2020).

plying that increases in debt should occur with a short delay. A shock that raises the five-year yield by 10 basis points leads to an increase in total public debt of about 0.6% after sixteen days.

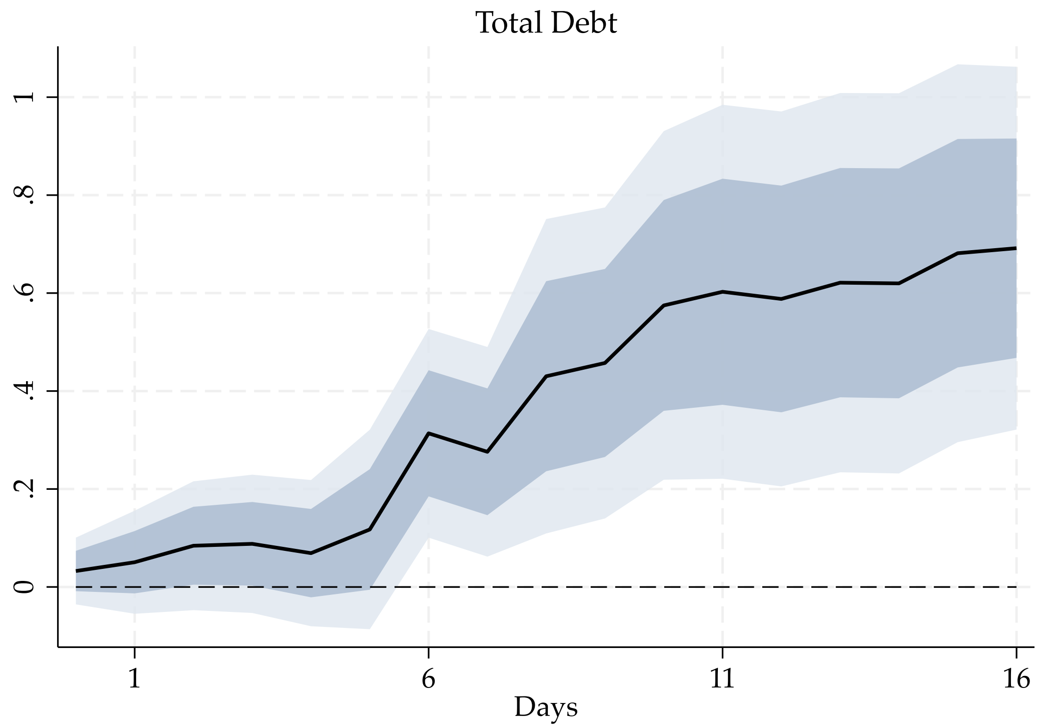

Figure 2: Impulse response of debt to a Treasury policy shock

Note: this figure shows the results of estimating equation (3), with y being total U.S. public debt outstanding. The x-axis shows days from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

To understand the macroeconomic and financial effects of debt supply, it is crucial to distinguish between short- and long-term debt. We define short-term debt as Treasury bills, that is, Treasuries with maturities of one year or lower. Long-term debt includes Treasuries with maturities of two years or longer. This distinction is motivated by the fact that short-term Treasury bills are fundamentally different from longer-term Treasuries: they are money-like instruments and carry essentially no duration risk. In contrast, coupon-bearing instruments such as Treasuries with maturities of two years or longer provide higher returns to investors at the expense of higher duration risk.

Figure 3 shows the impulse responses, at a monthly frequency, of both short- and long-term debt to a Treasury policy shock.[6] Short-term debt rises on impact and remains elevated for a sustained period before gradually reverting to zero after roughly twenty months. In contrast, the response of long-term debt is slower: initially, it does not move, but it gradually increases and exhibits much greater persistence than short-term debt.

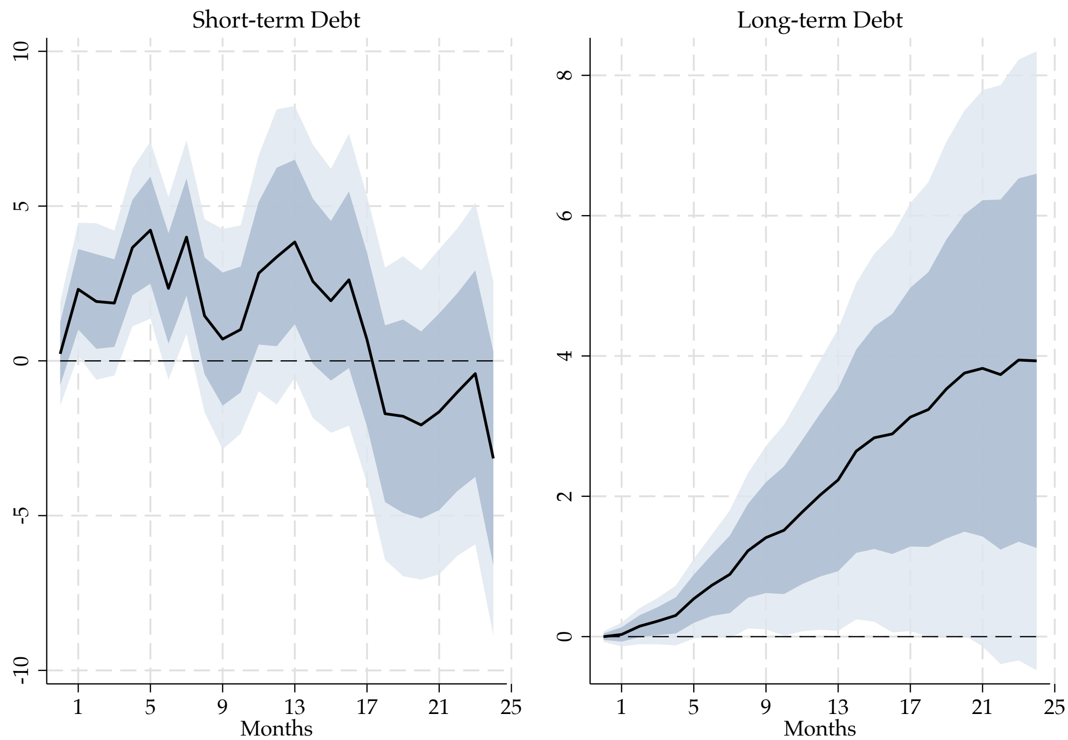

Figure 3: Short and long-term debt

Note: this figure shows the results of estimating equation (3). The left graph shows short-term debt, defined as every maturity of one year or lower; the right graph shows long-term debt, defined as two-year or longer Treasuries. The x-axis shows months from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

This pattern matches, at least anecdotally, the U.S. Treasury's debt issuance behavior during periods of increased borrowing. The Treasury primarily issues bills in the short-term, while the change in coupon-bearing issuances is more slow-moving. To understand the magnitudes of these effects, we also examine the response of overall public debt. Figure C1 shows that a 10 basis point increase in the five-year yield leads to an expansion of total U.S. public debt outstanding of about 2% after fifteen months. The result is robust

[6]Notice that short-term debt excludes cash-management bills. Long-term debt includes only Treasury notes and bonds, and it excludes TIPS and floating-rate notes. Our results are however robust to the inclusion of these Treasuries in the definition of short- and long-term debt.

to using other definitions of public debt, obtained as the sum of only Treasury bills, notes, and bonds (Figure C2), or computed as ratio to GDP or deflated using the GDP deflator (Figure C3).

We further show that the size of the Treasury General Account (TGA) greatly increases following our shock (Figure C4). This is consistent with the idea that the movement in futures prices partly reflects the discretion the U.S. Treasury has over the total size of borrowing at each point in time.

To explain the relationship between debt supply and bond prices, several theories emphasize the role of the total amount of duration risk that the market must absorb (Greenwood and Vayanos, 2014; Greenwood et al., 2014). Motivated by this insight, Figure C5 examines the response of duration-weighted debt-to-GDP. The figure shows a large and persistent increase, indicating that the exogenous rise in public debt supply substantially increases the amount of duration risk that investors must absorb.

A natural question is whether this increase in duration risk reflects a lengthening of the maturity structure of public debt. We examine this possibility in Figure C6. The weighted average maturity declines following the shock, but the effect is economically small (around 0.06 years), and the response—particularly when maturity is measured by duration—is rarely statistically significant. Combined with the evidence in Figure 3, these results indicate that our shock primarily captures an increase in the *level* of public debt outstanding rather than a change in its maturity composition. Consequently, the additional duration risk supplied to the market arises because debt issuance increases broadly across the maturity spectrum, rather than because the Treasury shifts issuance away from short- and toward longer-term securities.

Finally, our shock should also be distinct from news about fiscal deficits, since Treasury officials take taxes and government spending, as determined by Congress, as given. We assess this hypothesis by estimating the impulse responses of federal government expenditures and tax receipts to our shock. To do so, we aggregate the shock to the quarterly frequency from daily surprises following again Gertler and Karadi (2015).[7] In the specification, we include four lags of the shock, and of CPI, real GDP, and EBP as controls. Figure C7 presents the results. The only economically meaningful response is observed in federal interest payments. By contrast, expenditures net of interest payments remain largely unchanged over a two-year horizon. Results are unchanged if we express fiscal variables in nominal terms rather than scaling them by GDP.

[7] We verify that our results for macroeconomic aggregates that we report in Section 3.3 remain unchanged when estimated at the quarterly frequency (see Figure C25).

3.2. Financial effects

We now turn to the financial market response. The main result of this subsection is that Treasury policy shocks produce large and persistent movements in long-term yields, while leaving short-term rates essentially unchanged.

Figure 4 shows the impact response of the Treasury yield curve on the day of the announcement. This figure reveals a striking fact: following news about an increase in

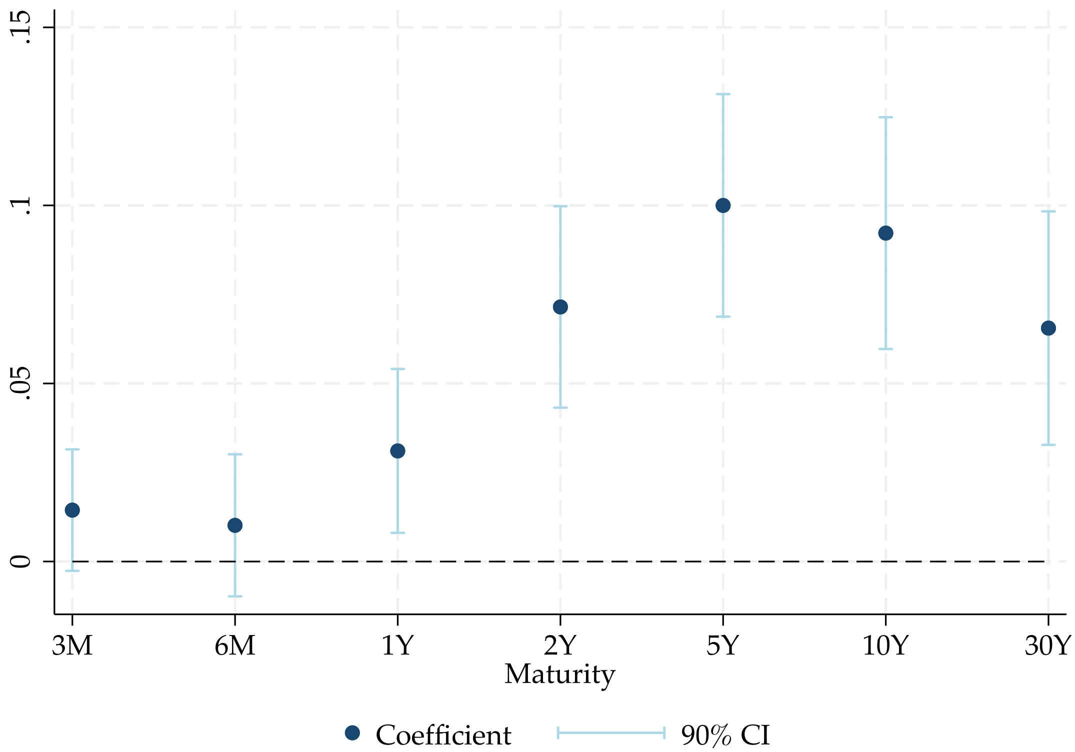

Figure 4: Yield curve impact response

Note: this figure shows the impact response of Treasury rates on the day of the shock. Treasury rates are end-of-day rates. The x-axis shows the maturity of each rate, while the y-axis shows the response in percentage points. The blue dots represent the point estimates, while light blue bars represent 90% heteroskedasticity-robust confidence intervals.

both short- and long-term public debt supply, short-term rates barely move, while long-term yields rise by a sizable amount. In particular, the responses of the three- and six-month Treasury rates are not significantly different from zero, while the one-year rate increases by about 2.5 basis points. At the same time, yields from two to thirty years rise by between 7.5 and 10 basis points, with the peak at the five-year maturity. This finding extends beyond the first day of the shock. Figure C8 presents the dynamic response of Treasury yields over a sixteen-day horizon. The response of short-term rates is almost never statistically different from zero, while long-term yields jump and remain elevated for about two weeks. More than half of this increase in long-term yields is explained by term premia (Figure C9).

An increase in Treasury yields matters directly for the government budget constraint, as higher interest rates imply a higher cost of financing. However, to assess whether Treasury announcements affect financial markets more broadly—and the macroeconomy—we must determine whether the rise in Treasury yields spills over to corporate rates. Figure C10 shows that the pass-through to corporate rates, as measured by Moody's Aaa corporate bond yield, is very high at around 90% (similar results are obtained when using Moody's Baa or High-Yield corporate bond yields, also shown in Figure C10).

Other responses. We also study the response of the stock market to the Treasury policy shock. Figure C11 shows the responses of the S&P 500 Index and the CBOE Volatility Index (VIX). There is no significant effect of Treasury announcements on the stock market. This finding, also documented by Phillot (2025), appears at odds with the large effects that Treasury policy has on Treasury yields. One possible explanation is that bond traders are fundamentally different from equity traders. Thus, following a Treasury announcement, while there are clear movements in the price (and therefore the yield) of government bonds, no significant change appears in the stock market.

We also examine breakeven inflation rates computed using TIPS (Figure C12). Interestingly, breakeven inflation rates do not react to a Treasury policy shock. This is particularly important, as one may worry that our surprise measure could be capturing news about an unexpected increase in government spending (or a reduction in taxes). If that were the case, one would naturally expect inflation expectations to move.

3.3. Macroeconomic effects

The final step is to assess whether the financial tightening induced by Treasury policy shocks translates into real economic effects. The main finding is that it does, with effects that are large, persistent, and concentrated in investment.

We showed that Treasury policy shocks reflect a surprise increase in both short- and long-term debt issuance. This increase immediately affects long-term yields, and the rise in Treasury yields spills over to corporate rates.

Figure 5 shows that a Treasury policy shock that raises the five-year yield by 10 basis points reduces industrial production by about 1.8% after one year. Prices also decline slightly, although the response of the price level is imprecisely estimated.

We further decompose the effect on output into investment and consumption expenditure. While the shock generates a contraction in both variables, the magnitudes differ substantially. Investment declines by nearly 4% at its trough, whereas consumption falls by only about 0.5%. Moreover, the decline in investment is considerably more persistent. Figure C14 also reports the responses of the unemployment rate and durable consumption. Durable consumption follows a pattern similar to that of overall consumption. The unemployment rate increases modestly, although the response is noisy. We return to this result when discussing the Fed's policy rate response in Section 5.

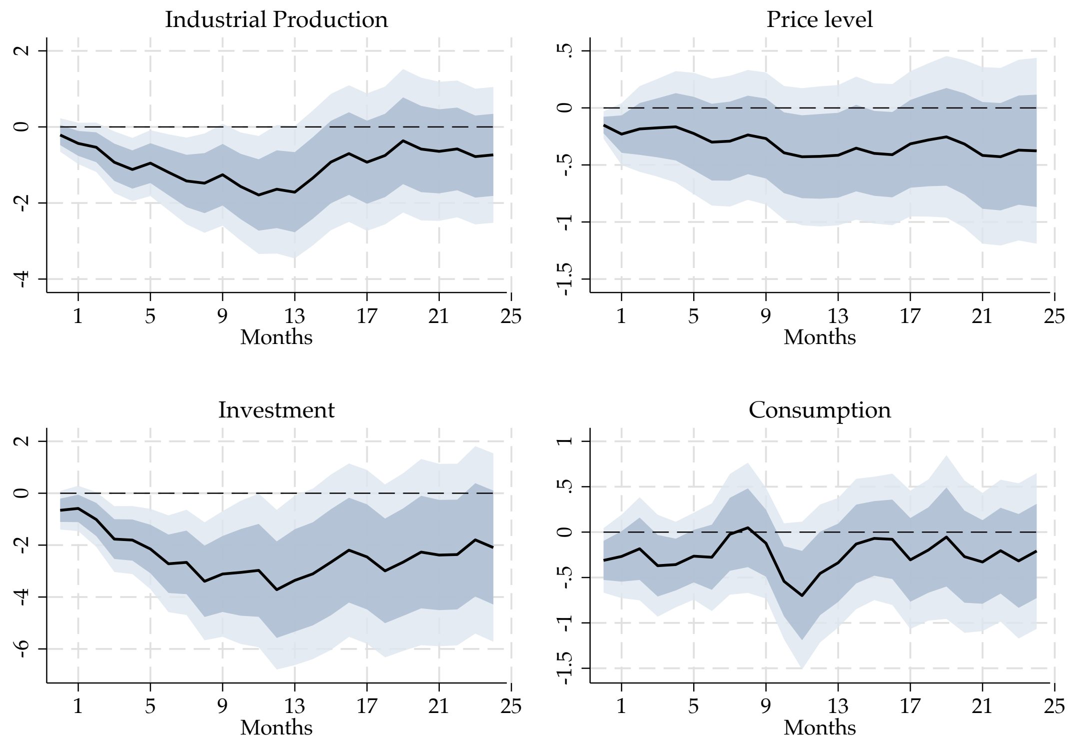

Figure 5: Macroeconomic effects of a Treasury policy shock

Note: this figure shows the results of estimating equation (3). The panels show the response of macroeconomic variables. The Price Level is the Consumer Price Index, Investment is equipment, a measure of real physical investment, while Consumption is real Personal Consumption Expenditure. The x-axis shows months from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

The macroeconomic effects of the Treasury policy shock are sizable. What is the mechanism behind this finding? We argue that the shock operates primarily through a tightening of financial conditions. As shown in the previous section, the Treasury policy shock generates a persistent increase in long-term Treasury yields (Figure C13). Figure C15 shows that these effects transmit more broadly to financial markets. The Financial Conditions Index rises on impact by roughly 10 basis points, pointing to a broad tightening in financial conditions. We also find sizable increases in measures of financial risk premia, such as the Baa–Aaa spread and the excess bond premium, with the former displaying particularly persistent effects. Overall, these results point to a significant deterioration in firms' financing conditions.

3.4. Robustness checks

Controls and subsamples. Figures 4 and 5 present our two main results. We now verify that these findings are robust to a variety of alternative specifications. For the daily responses shown in Figure 4, we show that the results are largely unchanged after including several additional controls. In particular, varying the number of lags (Figure C16) or modifying the set of controls (Figure C17) does not materially affect the findings. We also explore subsample stability. Splitting the sample into periods before and after December 2008, corresponding to the start of quantitative easing, or excluding the COVID period leaves the results essentially unchanged (Figure C18).

Turning to the monthly analysis, the results in Figure 5 are similarly robust across a wide range of specifications. Reducing the number of lags generally increases the magnitude of the responses, but the overall dynamics remain very similar (Figure C19). In our baseline specification, we include lags of the shock to account for potential serial correlation. Figure C20 shows that this choice is largely immaterial for the results. Likewise, varying the set of controls has little effect on the estimated responses (Figure C21). We also consider a larger sample for which the shock series is available, as well as a specification excluding the COVID period (Figure C22). Excluding the COVID period mainly attenuates the response of consumption, while leaving the remaining results broadly unchanged.

Finally, we perform two additional exercises. First, one may worry that some of our macroeconomic series exhibit trending behavior. Reassuringly, Figure C23 shows no evidence of pre-trends in the macroeconomic variables. Second, given the relatively short sample, one may be concerned that the results are driven by a few influential shocks. To address this concern, we conduct a jackknife exercise in which the shock is sequentially censored to zero one month at a time, while also controlling for a dummy corresponding to the censored month. Figure C24 shows that the point estimates remain remarkably stable across specifications.

Confidence intervals. In our baseline specification, we use heteroskedasticity-robust standard errors, following Montiel Olea and Plagborg-Møller (2021). We also verify that using Newey–West standard errors does not alter our main findings. Figure C26 shows that the results are nearly identical under the two approaches.

Finally, our shock series is constructed using principal component analysis. Estimating equation (3) therefore does not account for uncertainty arising from this first-stage estimation. To address this concern, we re-estimate the local projections using only the high-frequency change in the 10-year Treasury futures contract as the shock measure. Figure C27 shows very similar results, which, if anything, are estimated even more precisely.

Shock: window, aggregation, and other definitions. In our baseline analysis, we use a 60-minute window to compute high-frequency changes around policy announcements. However, we also verify that the results in Figure 5 are robust to alternative window lengths. Figure C28 replicates Figure 5 using high-frequency changes computed over three alternative windows: 10–20, 30–50, and 60–60 minutes. Reassuringly, the qualitative pattern of the responses is largely insensitive to the choice of window, even though the magnitude of the effect varies across window lengths.

In high-frequency studies, the method used to aggregate daily surprises can also matter. Our baseline specification follows the methodology proposed by Gertler and Karadi (2015) to address temporal aggregation bias. However, Figure C29 shows that the results are very similar when the series is aggregated simply by summing daily surprises within each month, as in Bauer and Swanson (2023) and Känzig (2021).

We also orthogonalize the shock with respect to information available prior to the announcement. Figure C30 shows that the resulting impulse responses are both qualitatively and quantitatively similar to those in Figure 5, consistent with the low R^2 obtained in the predictability regression (Table A4). Finally, we purge the shock series of potential information effects using the "Poor Man's" approach proposed by Jarociński and Karadi (2020).[8] Figure C31 shows that the results are essentially unaffected by this adjustment.

Different estimation strategy. So far, we have used local projections to estimate financial and macroeconomic effects. We can also explore whether adding more structure to our economic system materially changes the results. For this reason, we estimate a vector autoregression model (VAR) using the internal instrument approach (Plagborg-Møller

[8] Whenever the S&P 500 futures price does not move within the narrow window around the announcement, we classify the event as a standard Treasury policy shock. The absence of a stock market reaction suggests that the announcement is unlikely to contain a relevant information component.

and Wolf, 2021). We order our shock as the first variable and use a Choleski decomposition. The sample period runs from 2003:M7 to 2025:M2. We estimate a VAR including industrial production, CPI, the excess bond premium, and the five-year yield, and choose twelve lags. To estimate the responses of investment and consumption, we augment the VAR with each variable one at a time. Figure C32 displays the results and shows similar responses to the ones in Figure 5.

4. Treasury and monetary policy: an equivalence

The results in Section 3 show that Treasury policy shocks tighten financial conditions and generate sizable contractions in real activity: long-term Treasury yields rise, corporate borrowing rates increase with substantial pass-through, financial conditions deteriorate, investment declines, and output falls. This sequence closely resembles the textbook description of monetary policy transmission. This section examines how strong this similarity is in the data, both qualitatively and quantitatively.

To address this question, we conduct two exercises. First, we compare the empirical impulse responses of macroeconomic and financial variables to the Treasury policy shock and to an identified monetary policy shock from Bauer and Swanson (2023). Second, we augment a standard medium-scale DSGE model (Christiano, Eichenbaum, and Evans, 2005; Smets and Wouters, 2007) with a financial intermediation block and bonds of different maturities. Using this framework as a laboratory, we derive the model-implied impulse responses to Treasury and monetary policy shocks and compare them with their empirical counterparts.

Our main findings are as follows. First, in the time-series, both Treasury and monetary policy shocks generate large increases in long-term yields on impact. Second, the responses of real activity are similar, particularly for industrial production and investment. Third, the response of the yield curve across maturities differs sharply between the two shocks: monetary policy substantially affects the short end of the yield curve, whereas Treasury policy leaves short-term rates largely unchanged despite increasing issuance at both the short and long end. This distinction in yield-curve dynamics is central for interpreting the interaction between Treasury issuance and the Federal Reserve's policy implementation in Section 5.

Finally, the model clarifies the mechanism underlying the contraction in real activity. Both shocks place upward pressure on long-term interest rates, but through different channels. Following a Treasury policy shock, risk-averse arbitrageurs require compensation to absorb the additional duration risk, thereby pushing up long-term yields.

This mechanism is central to the models of Vayanos and Vila (2021) and Droste, Gorodnichenko, and Ray (2024). Following a contractionary monetary policy shock, instead, reach-for-yield investors rebalance their portfolios away from long-term debt and toward short-term assets, reducing the price of long-term bonds and increasing their yields.[9] Overall, the model confirms the insight that Treasury policy shocks operate as interest rate shocks.

4.1. Equivalence: evidence from time-series analysis

To compare Treasury and monetary policy shocks, we require an externally identified measure of unexpected monetary policy changes. We use the orthogonalized monetary policy surprises constructed by Bauer and Swanson (2023). Because this series is available at the daily frequency, we can directly use it to estimate daily local projections of the form given in equation (3).

To estimate monthly impulse responses, we similarly use the monthly aggregation of the orthogonalized monetary policy surprise series from Bauer and Swanson (2023). In the Appendix, we show that the results are very similar when using instead the monetary policy shock extracted from a VAR, following the approach proposed by Cloyne et al. (2023).

For the baseline analysis, we use the sample from 1988:M1 to 2020:M2 for the monetary policy shock (Bauer and Swanson, 2023). For the Treasury policy shock, we keep our baseline sample ranging from 2003:M7 to 2025:M2. We normalize both shocks so as to increase the five-year yield by 10 basis points on impact. Figure 6 shows the impact response of the yield curve on the day of a Treasury and a monetary policy announcement.

This figure reveals a striking pattern: both shocks push long-term interest rates up by a sizable amount. However, while the monetary policy shock increases short-term rates considerably, the Treasury policy shock does not affect short-term rates. Although surprising, this result is consistent with the working of monetary policy: the Fed implements its monetary policy by setting the federal funds rate, an overnight rate, which then spills over to the entire yield curve including the longer end.[10] Meanwhile, Treasury policy shocks have limited effects on the shorter end of the yield curve.

[9] Hanson and Stein (2015) argue that the presence of reach-for-yield investors is an important mechanism behind the large movements in long-term interest rates around conventional monetary policy announcements.

[10] It is worth highlighting that the monetary policy shock identified by Bauer and Swanson (2023) is constructed as the first principal component of four Eurodollar futures. Such contracts span a one-year horizon. It is therefore possible that this shock contains some "forward guidance", and this could help explaining the more pronounced response of the one- and two-year rates relative to the three-month rate.

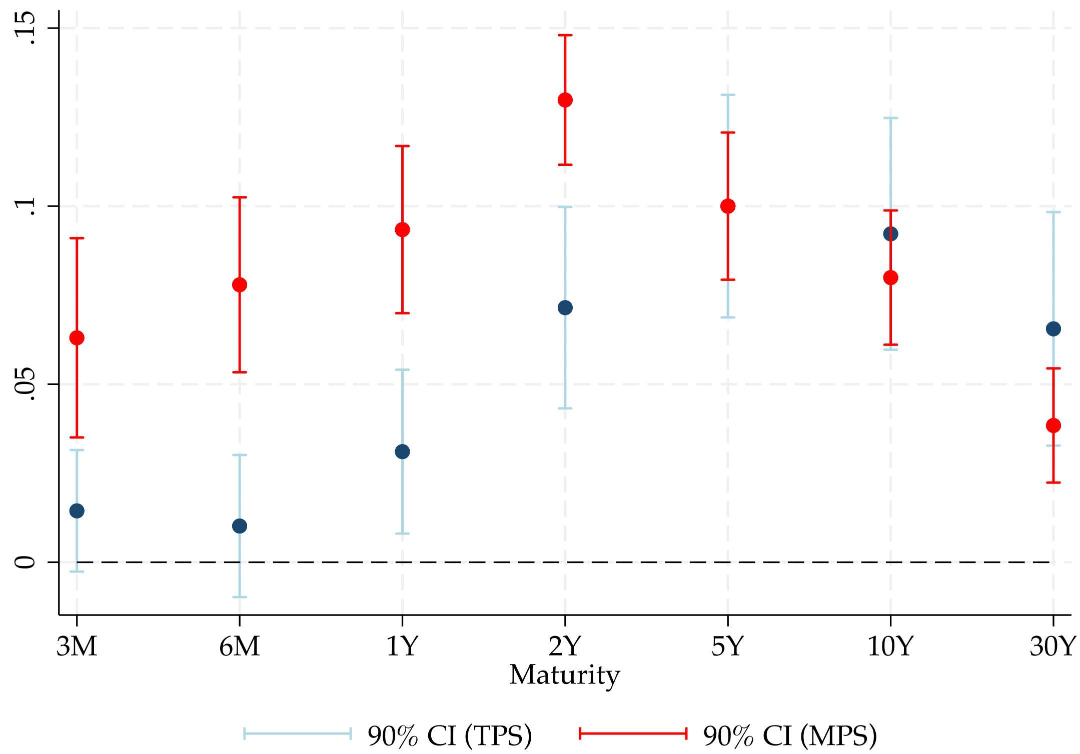

Figure 6: Yield curve response to Treasury and monetary policy shocks

Note: blue dots are the response of Treasury rates to a Treasury policy shock. Red dots are the response to a monetary policy shock. The shock corresponds to the orthogonalized surprises from Bauer and Swanson (2023). The x-axis shows the maturity of each security, while the y-axis the percentage points change. Estimation sample is 1988:M1 - 2020:M2 for the monetary policy shock; 2003:M7 - 2025:M2 for the Treasury policy shock. Vertical bars represent 90% heteroskedasticity-robust confidence intervals.

Figure 7 compares the responses of real variables to Treasury and monetary policy shocks. The impulse responses generated by the two shocks are remarkably similar, both qualitatively and quantitatively. Focusing on industrial production, the magnitude and persistence of the responses are strikingly alike across the two shocks, especially in the first year after the shock hits. A similar pattern emerges for real consumption expenditure. Turning to investment, it declines gradually following both shocks, although the response to the monetary policy shock is somewhat more delayed. Finally, prices exhibit broadly similar declines under the two shocks.

Figure D1 extends the analysis by comparing the responses of financial conditions across the two shocks. Relative to a Treasury policy shock, financial conditions exhibit a somewhat more persistent response following a monetary policy shock (even though the response of the Baa–Aaa spread is equally persistent). Figure D2 further shows that

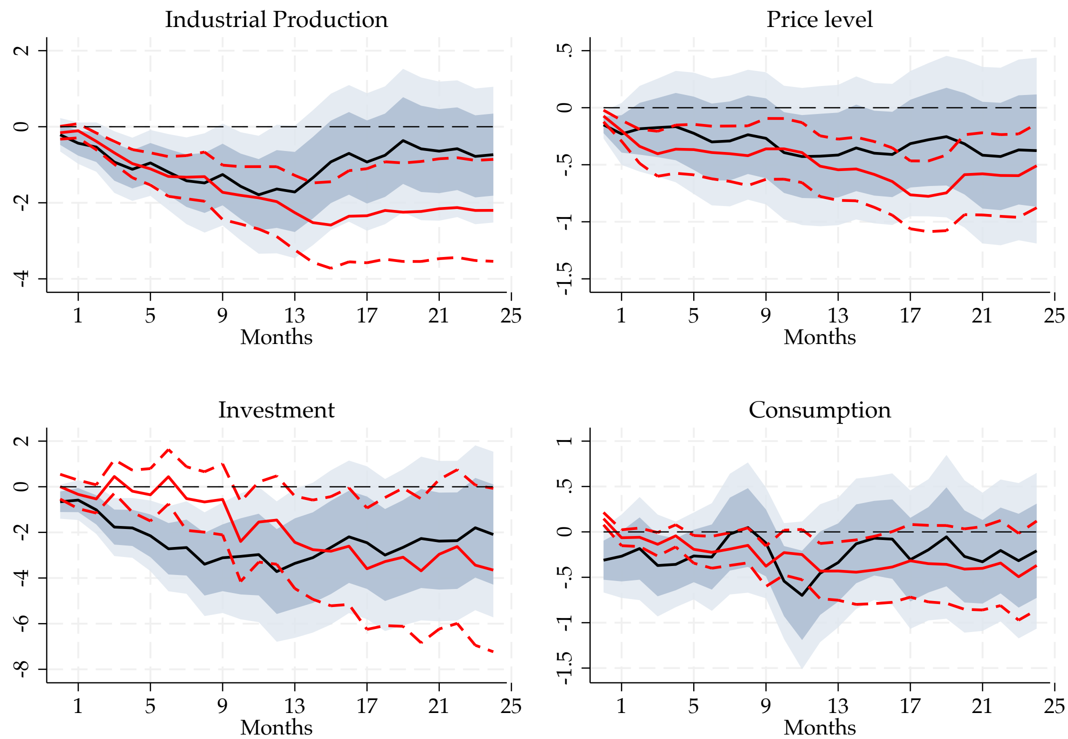

Figure 7: Macroeconomic responses to Treasury and monetary policy shocks

Note: the black solid line and the gray confidence bands correspond to the response of real variables to a Treasury policy shock. The red solid line and the dashed lines correspond to the point estimate and 68% confidence bands of the response to a monetary policy shock. The monetary policy shock is the orthogonalized surprise from Bauer and Swanson (2023). The x-axis shows months from when the shock hits, while the y-axis the percentage changes. Estimation sample is 1988:M1 - 2020:M2 for the monetary policy shock; 2003:M7 - 2025:M2 for the Treasury policy shock.

the similarity between the two shocks also extends to the responses of the unemployment rate and durable consumption.

The results presented so far are obtained by directly using Treasury policy and monetary policy surprises as shocks in the local projections. In the monetary policy literature, an alternative approach consists of identifying the shock within a proxy structural VAR and then using the resulting structural shock in local projections (Cloyne et al., 2023). We follow the same procedure and extract the monetary policy shock from the VAR (for details on the specification, see Appendix D.1). Figure D3 shows that the results remain extremely stable under this alternative identification strategy. The only notable difference is that the response of consumption to the monetary policy shock becomes slightly more muted relative to the baseline specification.

4.2. Equivalence: evidence from a medium-scale DSGE model

In this section, we consider a standard medium-scale DSGE model in the spirit of Christiano, Eichenbaum, and Evans (2005) and Smets and Wouters (2007). Our objective is to show that Treasury policy shocks transmit as interest rate shocks, similarly to conventional monetary policy. To this end, we feed in Treasury and monetary policy shocks consistent with the empirical impulse responses in the previous section, and show that the DSGE-implied responses match the empirical ones both qualitatively and quantitatively.

The model. We describe the main modifications we introduce to the model of Smets and Wouters (2007). The remaining blocks of the framework are standard and are discussed in Appendix D.2. In particular, we introduce two key modifications.

First, we incorporate three types of government bonds: short-term (s), medium-term (m), and long-term (l). This three-maturity model provides a parsimonious representation of the yield curve, corresponding to bills (short-term), notes (medium-term), and bonds (long-term). Following Woodford (2001), bonds pay geometrically decaying coupons at rates ρ_j for $j \in \{s, m, l\}$, where $\rho_s = 0 < \rho_m < \rho_l$. A unit of bond j purchased in period t pays ρ_j^{k-1} nominal units in period $t + k$. We assume that the Treasury supplies b_t^j units of each bond exogenously.

Throughout, hats denote log-deviations from steady-state values, which are denoted by asterisks. Let Q_t^j denote the price of bond j. The gross one-period return R_{t+1}^j and the yield-to-maturity $\mathcal{R}_t^j$ satisfy:[11]

$$\hat{R}_{t+1}^j = -\hat{Q}_t^j + \frac{\rho_j}{R_*}\hat{Q}_{t+1}^j \tag{4}$$

$$\hat{\mathcal{R}}_t^j = -\frac{1}{Q_*^j R_*}\hat{Q}_t^j \quad \text{for } j \in \{s, m, l\} \tag{5}$$

Second, we assume that households deposit their savings into a mutual fund, which allocates these funds across different classes of investors. This structure immediately implies that the interest rate faced by households differs from the short-term rate R_t^s. Denoting the ex-post return on the mutual fund by R_{t+1}, the household Euler equation becomes

$$\hat{\zeta}_t = \mathbb{E}_t\left[\hat{\zeta}_{t+1} + \hat{R}_{t+1} - \hat{\pi}_{t+1}\right], \tag{6}$$

where ζ_t denotes the marginal utility of consumption and π_{t+1} inflation.

Since investors have access to bonds of different maturities, the return on deposits is

[11] Our assumptions imply that all bonds earn the same steady-state gross return R_*.

given by a market-value-weighted average of bond returns:

$$\hat{R}_{t+1} = \sum_{j \in \{s,m,l\}} \underbrace{\frac{Q_*^j b_*^j}{\sum_{k \in \{s,m,l\}} Q_*^k b_*^k}}_{\text{market share of bond } j} \hat{R}_{t+1}^j. \tag{7}$$

We assume that investors belong to three distinct groups. Following Vayanos and Vila (2021), the financial sector features preferred habitat investors and arbitrageurs. Preferred habitat investors have an inelastic demand for securities at specific maturities, capturing institutions such as pension funds or money market funds. Arbitrageurs, such as hedge funds or primary dealers, have standard mean-variance preferences, capturing the idea that they require compensation to hold long-term debt because such assets are exposed to duration risk. Following Hanson and Stein (2015), we also introduce "reach-for-yield" investors. Unlike arbitrageurs, these investors do not base their portfolio decisions on expected returns, but instead on the current yield-to-maturity.

Before turning to the bond pricing equilibrium conditions, it is useful to clarify the role played by arbitrageurs and reach-for-yield investors in the model. Arbitrageurs generate a downward-sloping demand curve for medium- and long-term debt.[12] Since long-term Treasuries carry duration risk, risk-averse investors require compensation to absorb additional long-duration assets. As a result, an increase in the supply of long-term debt puts upward pressure on long-term interest rates. This mechanism lies at the core of modern term structure models (Vayanos and Vila, 2021) and has been widely used to study the effects of quantitative easing (Droste, Gorodnichenko, and Ray, 2024).

The presence of reach-for-yield investors is instead necessary to match the observed on-impact response of long-term Treasury yields to conventional monetary policy shocks.[13] As emphasized by Hanson and Stein (2015), movements in long-term yields around monetary policy announcements are too large to be fully explained by changes in expected future short rates alone. Following an unexpected increase in the policy rate, reach-for-yield investors—who focus on current yields rather than expected returns—rebalance their portfolios toward short-term securities and away from long-term bonds. This portfolio reallocation lowers the price of long-term Treasuries and raises their yields, allowing

[12] Whenever we write "long-term debt", we mean both medium and long-term debt. These Treasuries carry duration risk, and are different from short-term debt.

[13] This mechanism represents only one of several explanations proposed in the literature for the response of long-term interest rates to conventional monetary policy (i.e. excluding announcements about QE). We focus on it because it can be incorporated relatively easily into our DSGE framework. Nevertheless, other mechanisms may also contribute to the sizable movements in long-term rates observed following monetary policy announcements.

the model to replicate the observed impact response of the yield curve to conventional monetary policy shocks.

This investor structure yields the following bond pricing system:

$$\begin{bmatrix} b_*^m \hat{b}_t^m \\ b_*^l \hat{b}_t^l \end{bmatrix} = \Sigma \left(\frac{1}{\psi^a} \begin{bmatrix} Q_*^m \left(\mathbb{E}_t \hat{R}_{t+1}^m - \hat{R}_t^s \right) \\ Q_*^l \left(\mathbb{E}_t \hat{R}_{t+1}^l - \hat{R}_t^s \right) \end{bmatrix} + \frac{1}{\psi^r} \begin{bmatrix} Q_*^m \left(\hat{\mathcal{R}}_t^m - \hat{R}_t^s \right) \\ Q_*^l \left(\hat{\mathcal{R}}_t^l - \hat{R}_t^s \right) \end{bmatrix} \right), \tag{8}$$

where Σ denotes the inverse variance-covariance matrix of bond returns, while ψ^a and ψ^r are the risk tolerance parameters of arbitrageurs and reach-for-yield investors, respectively. The demand for bond j increases when either its expected return, $\mathbb{E}_t \hat{R}_{t+1}^j$, exceeds the short-term rate, through the arbitrageur channel, or when its yield-to-maturity, $\hat{\mathcal{R}}_t^j$, exceeds the short-term rate, through the reach-for-yield channel. The strength of these responses is governed by the corresponding risk tolerance parameters: lower values of ψ^a and ψ^r, corresponding to greater risk tolerance, amplify the demand response to return differentials. Finally, Σ governs cross-maturity comovement and the resulting cross-price elasticities. Together with the definition of one-period return and yield-to-maturity (equations (4) and (5)), equation (8) determines equilibrium bond prices and returns for a given path of exogenous bond supply.

IRF matching exercise. Using our local projection estimates,[14] we recover the sequences $\{\hat{b}_{t+1}^m, \hat{b}_{t+1}^l\}_{t=0}^{34}$ associated with Treasury policy shocks and $\{\hat{R}_t^s\}_{t=0}^{7}$ associated with both monetary and Treasury policy shocks. We then feed shocks into the model to match these responses: the short-term rate alone for the monetary policy shock, and the bond paths jointly with the policy rate for the Treasury policy shock.

More specifically, we invert the DSGE model to recover the implied fundamental shocks to bond supply and monetary policy. We then feed these shocks into the full DSGE framework and compare the model-implied responses of macroeconomic variables to their empirical counterparts estimated using local projections.

We list estimated parameters in Table D1. These parameters are estimated by minimizing the distances to: a) the on-impact empirical responses of the 3-month, 5-year, and 10-year interest rates to both Treasury and monetary policy shocks; b) the empirical responses of output, investment, consumption, and the price level (see Appendix D.2 for more details). The other parameters are set equal to the posterior mode estimates reported in Smets and Wouters (2007) (see Table D2).

[14]The local projections are monthly whereas the DSGE model is quarterly. We associate each quarterly response with the corresponding mid-quarter (second-month) monthly response, in the spirit of Camara, Christiano, and Dalgıc (2025).

Using these shocks and the corresponding model parametrization, Figures D6 and 8 compare the model-implied impulse responses of the yield curve, and of macroeconomic variables to their empirical counterparts, respectively. As the figures show, the model is able to replicate reasonably well the empirical responses documented in Section 4.1.

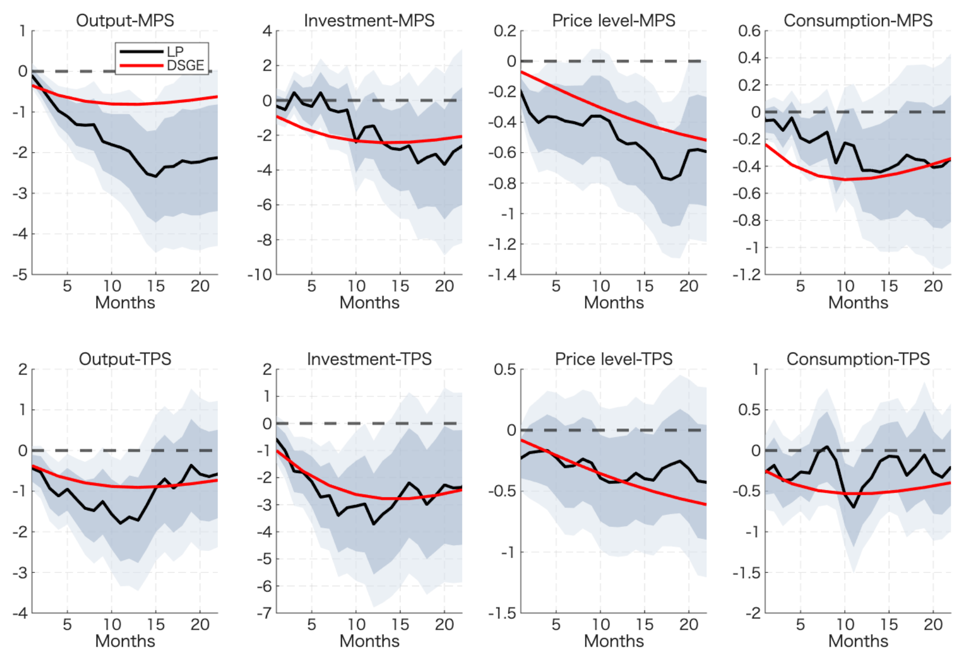

Figure 8: Model-implied and empirical IRFs to Treasury and monetary policy shocks

Note: the figure compares empirical and model-predicted impulse responses to a Treasury and a monetary policy shock. The upper panel shows the responses to a Treasury policy shock (TPS); the lower panel shows the responses to a monetary policy shock (MPS). The black solid line represents the point estimate of the empirical IRFs, with shaded gray areas representing 68% (dark) and 90% (light) heteroskedasticity-robust confidence bands. The red solid line is the model-predicted impulse response.

The key channel behind these results is the increase in long-term interest rates following both shocks. Following a Treasury policy shock, arbitrageurs require additional compensation to absorb the increase in duration risk, thereby pushing up long-term yields. Following a monetary policy shock, reach-for-yield investors rebalance their portfolios toward short-term securities, selling long-term Treasuries and putting upward pressure on long-term rates.

In the Appendix, we show that the equivalence implied by the model is robust to alternative IRF-matching strategies. In particular, the results remain unchanged when we target the average response of short-, medium-, and long-term interest rates rather than the three maturities considered (Figures D7 and D8).

Overall, this section shows that a standard medium-scale DSGE model, augmented with a parsimonious financial block, is able to replicate the empirical impulse responses to both Treasury and monetary policy shocks. Despite having distinct effects on the shape of the yield curve, both shocks influence long-term interest rates and give rise to remarkably similar macroeconomic dynamics. This exercise reinforces the main intuition from Section 4.1: Treasury policy shocks operate as interest rate shocks, generating effects that closely resemble those of conventional monetary policy.

5. How does the Fed respond to Treasury policy?

The previous sections establish that Treasury policy shocks have sizable effects on financial conditions and real economic activity, mirroring conventional monetary policy shocks. This naturally raises a further question: does the Federal Reserve respond to Treasury policy, and if so, through which instruments? The answer is not obvious *a priori*. On the one hand, Treasury issuance affects aggregate demand and financial conditions, and thus represents a disturbance that a central bank pursuing its dual mandate might want to offset. On the other hand, the Federal Reserve has consistently emphasized its institutional independence from fiscal authorities and has sought to distance monetary policy from debt management considerations (Greenwood et al., 2015).

This section shows that, on average over our sample, the Fed responds to Treasury policy shocks—not through its policy rate, but through its balance sheet. Following an unexpected increase in Treasury issuance, the Fed expands its holdings of both short- and long-term Treasuries. While we cannot claim that this occurs on a period-by-period basis, the average response is economically important: the Fed fully sterilizes short-term issuance and partially offsets long-term issuance. This response helps reconcile two facts documented earlier: large increases in debt supply at both ends of the maturity spectrum, and the near absence of any movement in short-term rates.

5.1. Empirical evidence

Data. To answer this question, we require data on the Fed's policy instruments. Because a substantial portion of our sample covers the zero lower bound (ZLB) period, we use the shadow rate constructed by Wu and Xia (2016) as our measure of the policy rate during periods in which the federal funds rate is constrained.[15]

[15] We define the zero lower bound period as months in which the federal funds rate is at or below 0.5 percent, following Miyamoto, Nguyen, and Sergeyev (2024). The only exceptions are 2022:M3 and 2022:M4, when the federal funds rate remained below 0.5 percent but the shadow rate series is unavailable, as it ends

To measure the Fed's balance sheet, we use data on Treasury holdings from the System Open Market Account (SOMA). These data are available at the monthly frequency from July 2003 through February 2025. Importantly, the data also provide information on the maturity composition of Treasury holdings, allowing us to decompose the Fed's portfolio into short- and long-term securities. To provide background on the Fed's balance sheet behavior over this period, Figure E4 shows the evolution of the Fed's Treasury holdings, broken down into short- and long-term debt. Short-term debt was around $280 billion before the crisis; it then fell and reached zero by August 2012. It remained at zero until May 2019. Its level subsequently surged, as the Fed launched a program in October 2019 to purchase short-term debt following a spike in repo rates.

Turning to the right panel, surges in the amount of long-term debt held by the Fed coincide with the various QE programs. The two declines instead correspond to the two rounds of Quantitative Tightening (QT), the first beginning in October 2017 and the second in June 2022. The notable exception is the sharp increase in Treasury purchases during COVID, from March to July 2020. This program was aimed at restoring order in Treasury markets. As Bernanke (2022) notes, "this purchase was different from QE in that it occurred across a wide range of maturities and was targeted at stabilizing financial markets." (see Bernanke (2022), p. 261).

Empirical strategy. The Fed sets its monetary policy stance based on economic conditions. A simple regression of Fed policy variables on changes in Treasury policy would yield biased estimates due to endogeneity. Instead, we leverage our identified Treasury policy shock and estimate a local projection of the following form:

$$y^{Fed}_{t+h} - y^{Fed}_{t-1} = \alpha_h + \beta^{Fed}_h shock_t + \gamma^{Fed}_h \mathbf{X}_{t-p} + \varepsilon_{t+h} \tag{9}$$

where y^{Fed} is the Fed policy variable and *shock* is the Treasury policy shock. Controls are the same as in the specification estimated in Section 3. It is important to stress that β^{Fed} captures an *average* effect over our sample period, which goes from 2003:M7 to 2025:M2. As before, every impulse response is normalized to correspond to a 10 basis point increase in the five-year yield on impact.

Results. Figure 9 reports the responses of the Federal Reserve's Treasury holdings—split into short- and long-term securities—as well as the response of the policy rate. Responses

in 2022:M2. For these two months, we therefore use the federal funds rate instead. This procedure yields a ZLB period broadly similar to that considered by Ramey and Zubairy (2018). We verified that our results are similar if we define the ZLB when the federal funds rate is at or below 0.25.

of Treasury holdings are expressed in standard deviations of the corresponding y variable. Because the series for the Fed's holdings of short-term Treasuries contains occasional zeros, percentage changes cannot be computed.

Turning first to the balance sheet response, a Treasury policy shock leads the Fed to expand its Treasury holdings. The increase is particularly pronounced for short-term securities. Two years after the shock, the response reaches roughly 0.3 standard deviations, corresponding to an increase of about $40 billion in the Fed's short-term Treasury holdings. The response of long-term Treasury holdings follows a similar pattern. Two years after the shock, the effect amounts to roughly 0.2 standard deviations. Because the standard deviation of this series is much larger—about $1.4 trillion—the implied increase in long-term Treasury holdings is substantial, reaching approximately $280 billion after two years.

We next examine whether the Federal Reserve adjusts its conventional monetary policy instrument, namely the policy rate. Figure 9 shows no evidence of a systematic policy rate response following a Treasury policy shock. The estimated response remains statistically indistinguishable from zero at all horizons, even at the 68% confidence level.

Overall, the evidence suggests that the Federal Reserve does not react to Treasury policy shocks by adjusting the policy rate. Instead, its response appears to operate primarily through changes in the composition and size of its balance sheet. This naturally raises the question of why the Fed behaves in this way.

Focusing on the short-term debt response, buying and selling Treasuries has historically been the traditional way in which the central bank set its policy rate in a scarce-reserve system (i.e., before the start of QE). In such a system, an increase in Treasury bills supplied by the government would lower the price of short-term debt, raising its yield. A central bank aiming to keep its short-term policy rate constant would therefore need to step in and purchase short-term Treasuries from primary dealers to counteract the effect of additional bill issuance. More specifically, the Federal Reserve targets the federal funds rate and closely monitors repo rates. To the extent that an increase in the supply of Treasury bills raises short-term rates—and these spill over to the repo market or to the federal funds rate—the Federal Reserve may be prompted to act in order to keep its policy rate on target.[16]

Although the monetary policy framework has changed since QE, similar considerations remain relevant. Under the current ample-reserve regime, short-term rates are

[16]From an optimal policy perspective, Vissing-Jorgensen (2025) argues that active adjustments in Treasury bill purchases provide the Federal Reserve with the most effective tool for accommodating fluctuations in the Treasury General Account (TGA) generated by Treasury debt issuance.

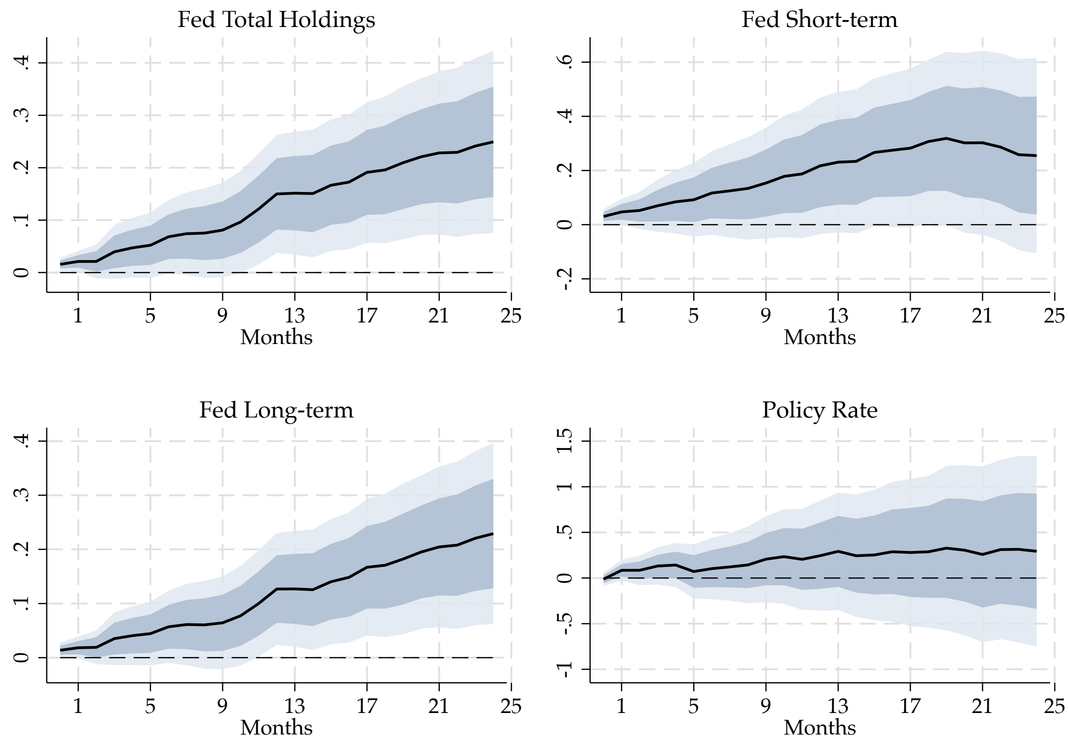

Figure 9: Fed's response

Note: this figure shows the results of estimating equation (9). The upper-left panel shows the amount of Fed's total Treasury holdings; the upper-right panel the amount of Fed's short-term (one year of maturity or lower) Treasury holdings; the bottom-left panel the long-term (two years or longer); the bottom-right panel the Fed's policy rate. The policy rate is the federal funds rate in periods outside the ZLB, and the shadow rate from Wu and Xia (2016) for the ZLB periods. We define the ZLB periods as months when the federal funds rate was at or below 0.5. The x-axis shows months from the shock, while the y-axis shows the response in standard deviations of the y variable for Treasury holding variables, and in percentage points for the policy rate. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

largely controlled through the Interest on Reserve Balances (IORB). However, unexpected increases in Treasury issuance can still create pressures in funding markets by increasing the demand for liquidity among primary dealers. If reserves become scarce, the Fed's ability to maintain control over short-term rates may be impaired. As a result, the Federal Reserve may still choose to purchase short-term Treasury securities to preserve ample reserve conditions and stabilize money markets.

The events surrounding the 2019 repo market turmoil provide a useful illustration. Following a larger-than-expected increase in Treasury bill issuance, primary dealers faced difficulties absorbing the additional supply because of limited liquidity. In response, the

Federal Reserve began purchasing approximately $60 billion of Treasury bills per month through at least the second quarter of 2020 (see Bernanke (2022), pp. 248–252). The fact that we find no meaningful response of the policy rate, combined with a sizable increase in the Fed's holdings of short-term debt, is consistent with this interpretation.

Taken together, these considerations suggest that the Federal Reserve offsets the effects of short-term Treasury supply in order to maintain control over its operating target. If market participants expect the Fed to absorb much of the additional bill issuance, equilibrium short-term rates need not adjust significantly on impact. This mechanism complements the existing literature documenting a relatively low sensitivity of short-term rates to debt supply. Jiang, Richmond, and Zhang (2025) show that the convenience yield at the short end of the yield curve is relatively insensitive to changes in the supply of short-term government debt. We build on this evidence by highlighting an additional channel operating through the Fed's balance sheet: sterilization at the short end further dampens the response of short-term rates to debt issuance.

The situation is different at the long end of the yield curve. Although the Federal Reserve increases its holdings of long-term Treasury securities following the shock, the response is only partial and long-term yields still rise. The question is therefore why the Fed does not fully sterilize the increase in long-term debt supply. One possibility is that policymakers are concerned about increasing the maturity mismatch on the Fed's balance sheet. The Fed's principal liability—bank reserves—is effectively short-term, whereas Treasury notes and bonds are long-term assets. A second possibility is that large-scale purchases of long-term securities remain politically contentious. Unlike traditional open market operations in Treasury bills, QE has often been viewed as an unconventional policy tool and has faced criticism both within and outside the central banking community (Bernanke, 2022).

Finally, one may wonder why, despite the contraction in economic activity and prices, the Fed does not alter its policy rate. One possible explanation is that the decline in economic activity induced by the shock is not sufficiently large to warrant an expansionary response. As shown in Figures 5 and C14, prices and employment decline following the shock, but the magnitudes are relatively modest. A central bank focused on stabilizing inflation and employment (rather than industrial production) may therefore see little reason to adjust its policy rate. Moreover, although the Fed keeps short-term rates unchanged, it does increase its holdings of long-term Treasury securities, thereby providing some accommodation through its balance sheet. Finally, policymakers may be reluctant to adjust the policy rate in response to a disturbance originating from the fiscal authority. Indeed, the Federal Reserve and the Treasury have long sought to present themselves as separate and independent institutions.

In Section 5.2, we provide anecdotal evidence from FOMC minutes and meeting transcripts that is consistent with this interpretation of the Fed's behavior. Before turning to that discussion, however, we show that the results reported in Figure 9 are robust to alternative specifications, sample choices, and the exclusion of outliers.

Robustness checks. We first verify that our results are robust to alternative specifications. In particular, we consider excluding deterministic controls or adding a linear trend. Figure E1 shows that the main results remain essentially unchanged. Additionally, excluding the Covid episode or extending the sample back to 1998 does not alter our findings (Figure E2).

We also investigate the presence of pre-trends in the Fed's policy variables. Figure E3 shows no evidence of pre-trends in either the policy rate or the Fed's holdings of long-term Treasuries. While holdings of short-term Treasuries display a pre-trend, it is in the opposite direction of the estimated post-shock response, suggesting that the baseline results are unlikely to be driven by underlying trends in the data.

It is important to emphasize that the local projections estimate an *average* response over the sample period. As a result, we cannot conclude that the Federal Reserve actively sterilizes Treasury debt issuance on a period-by-period basis. This observation raises the question of whether the estimated responses are driven by a small number of extreme episodes. As shown in Figure E4, both short- and long-term Treasury holdings exhibit unusually large changes, raising the possibility that outliers disproportionately influence the estimated average effects.

To investigate this issue, we first present scatter plots of the conditional correlation between Treasury policy shocks and the Fed's holdings of short- and long-term Treasuries (Figures E5 and E6). The largest correlations coincide with the repo market turmoil and the onset of quantitative easing, for both short- and long-term Treasury holdings. This is unsurprising, as these episodes correspond to major shifts in the composition and size of the Federal Reserve's balance sheet.

Motivated by this observation, Figure E7 shows that our results remain robust after winsorizing extreme observations in the Fed's Treasury holdings. In addition, Figure E8 reports estimates from local projections that exclude these two episodes. The results remain robust when either episode is excluded from the sample.

5.2. Anecdotal evidence from FOMC documents

In this section, we provide two examples to help illustrate the rationale behind the Fed's intervention in Treasury markets following an increase in Treasury debt supply. The first episode is the spike in repo rates at the end of 2019, which followed a surge in short-term debt issuance by the Treasury. Faced with a sharp increase in liquidity demand from primary dealers, the Fed intervened by purchasing large quantities of short-term Treasuries in exchange for reserves. This episode shows that, even in an ample-reserve system (in place since late 2008), the Fed may still need to buy or sell short-term Treasuries to maintain control of its policy rate.

Regarding the long end of the curve, we did not find an instance in which Fed officials explicitly commented on Treasury long-term debt issuance. However, we provide evidence from the QE era that Fed officials were fully aware of the effects Treasury policy could have on financial conditions and the broader economy. Taken together, we view this anecdotal evidence as suggestive of the rationale behind the Fed's balance sheet adjustments in response to Treasury policy.

The 2019 repo spike. In September 2019, turmoil erupted in repo markets. While the target federal funds rate was around two percent, the repo rate spiked to as high as ten percent. At the FOMC meeting on September 18, Fed officials noted that

> *"Open market operations conducted on the previous day had helped to ease strains in money markets, but the EFFR had nonetheless printed 5 basis points above the top of the target range."*

At the post-meeting press conference, Fed Chair Jerome Powell attributed the surge in repo rates to a sudden increase in the demand for liquidity. Importantly, he suggested that the surge in demand from primary dealers was driven in part by increased issuance of new debt from the Treasury (Bernanke, 2022). The larger-than-expected debt supply was concentrated at the short end of the curve (Figure F1). We see no sudden change in the growth rate of long-term debt issuance. On the contrary, short-term debt issuance exhibited a spike in August 2019.

In response to this instability in short-term funding markets, Fed officials began developing plans to address the issue. As written in the minutes of the September 18–19 meeting:

> *"Participants agreed that developments in money markets over recent days implied that the Committee should soon discuss the appropriate level of reserve balances suffi-*

cient to support efficient and effective implementation of monetary policy in the context of the ample-reserves regime that the Committee had chosen. A few participants noted the possibility of resuming trend growth of the balance sheet to help stabilize the level of reserves in the banking system."

Fed officials thus began considering expanding their balance sheet again after a period of QT. However, this expansion was explicitly distinguished from QE:

> *"Participants agreed that any Committee decision regarding the trend pace of balance sheet expansion necessary to maintain a level of reserve balances appropriate to facilitate policy implementation should be clearly distinguished from past large-scale asset purchase programs that were aimed at altering the size and composition of the Fed's asset holdings in order to provide monetary policy accommodation and ease overall financial conditions."*

These minutes suggest that Fed officials were concerned about the increase in liquidity demand—driven in part by the Treasury's larger-than-expected short-term issuance—and the potential for reserve scarcity to impair the Fed's ability to control its short-term policy rate. The minutes from the subsequent FOMC meeting on October 29–30 emphasize this point:

> *"On October 11, the Committee announced its decision to maintain reserves at or above the level that prevailed in early September through a program of Treasury bill purchases and repurchase agreement (repo) operations."*

More specifically, the FOMC announced it would begin increasing reserves by purchasing $60 billion of short-term Treasuries per month, at least through the second quarter of 2020 (Bernanke, 2022). This is visible in the variation over time of the amount of short- and long-term Treasuries held by the Fed (Figure F2). Importantly, Fed officials stressed that these actions did not represent a shift in monetary policy—unlike QE, they did not involve purchasing long-term Treasuries—but were instead purely "technical measures." The goal was to maintain an adequate level of reserves in order to keep the federal funds rate on target. In their own words:

> *"Participants emphasized the importance of maintaining reserves at a level consistent with the Committee's choice of an ample-reserves monetary policy implementation framework, in which control over the level of the federal funds rate is exercised primarily through the setting of the Fed's administered rates and in which active management of the supply of reserves is not required."*

Thus, even in the post-2008 regime, a sudden increase in liquidity demand may require the Fed to actively manage reserves—via purchases or sales of Treasuries—in order to maintain control of its policy rate. This episode aligns closely with the empirical evidence presented in Section 5.1.

Response at the long end. As noted by Greenwood et al. (2014), during the period from the launch of QE through 2014, the Treasury progressively increased the relative issuance of long-term debt. According to their estimates, Treasury policy was able to undo more than a third of the stimulative effects generated by QE. This calculation is based on the high-frequency variation in the ten-year yield around QE and QRS announcements.

Searching through the minutes, we did not find an episode in which Fed officials explicitly discussed the Treasury's long-term debt issuance. As suggested by Greenwood et al. (2014), in discussing QE policies the Fed focused exclusively on how asset purchases would affect long-term rates and, in turn, the macroeconomy. It purposely avoided discussing implications for government fiscal risk, likely because the Fed does not want to be seen as monetizing fiscal deficits. Nevertheless, by looking at the Meeting Transcripts, we do find evidence that Fed policymakers were aware of the potentially significant effects that Treasury policy could have on the economy.

During the November 2–3, 2010 FOMC meeting, Charles Plosser, then president of the Philadelphia Fed, posed the following question to Brian Sack, then manager of the System Open Market Account:[17]

> *"Brian, do you think there'd be any difference between the duration effects of our purchases that you're talking about, and those if the Treasury announced a program to quit issuing long-term bonds and issued short-term bonds instead to fund the deficit?"*

Sack replied:

> *"Conceptually, under the portfolio-balance view, those two do have similar effects. The effects we're talking about arise from the amount of duration that's left for the private sector to hold, and that could be changed through debt management decisions just as easily as it could be changed through our portfolio decisions. But there are two differences to highlight. First, we can move a lot more quickly than debt managers—obviously, as they change their issuance calendars, that changes duration, but only slowly, as the auctions occur, and we can move faster than that. Second, debt managers do not have an economic mandate. They operate under a mandate of being regular and*

[17] See the Transcript of the Federal Open Market Committee Meeting on November 2–3, 2010, p. 24.

> *predictable and minimizing their borrowing costs over time, so they don't really have a clear structure through which they should make debt management changes like that in order to affect economic outcomes."*

This exchange illustrates two points. First, during the QE period, Fed officials were clearly aware of the interaction between their balance sheet policy and Treasury debt issuance.[18] Second, they believed that the central bank could act more quickly than the Treasury, and therefore could potentially sterilize the market effects of changes in debt issuance.

We view this anecdotal evidence as suggestive of the potential interaction between the Fed's balance sheet policy and Treasury debt issuance at the long end. The fact that Fed officials openly discuss Treasury issuance at the short end, but rarely at the long end, suggests that markets perceive the two domains differently. As explained by Bernanke (2022), the Fed's purchase of long-term debt is seen as unconventional and politically charged. By contrast, central bank interventions in the short-term funding market are standard operating procedures and have long been the primary way through which the Fed implements monetary policy.

6. Conclusion

This paper asks whether Treasury debt management policy has important macroeconomic effects. We identify a Treasury policy shock using high-frequency movements in Treasury futures around U.S. Treasury issuance announcements. We show that unexpected increases in public debt supply raise long-term interest rates, pass through to corporate borrowing costs, tighten financial conditions, and generate a persistent contraction in investment and output. The aggregate effects and transmission mechanism closely mirror those of a conventional monetary policy tightening, as both shocks affect long-term Treasury yields.

We further show that Treasury issuance shapes the Fed's balance sheet. The Fed adjusts its holdings of Treasury securities to preserve adequate liquidity conditions: its total purchases are calibrated to keep short-term rates at target, but the composition of those purchases is biased toward short-term securities, only partially offsetting the rise in long-term yields induced by higher long-term issuance.

[18] To be precise, Brian Sack's remark concerns the Treasury's management of the maturity composition of public debt rather than changes in the amount of debt supplied at a particular auction. Nevertheless, we interpret this exchange as evidence that Federal Reserve officials recognized the potential influence of Treasury policy—broadly defined—on financial markets and macroeconomic outcomes.

Taken together, our paper shows that debt management decisions can have effects that closely resemble those of conventional monetary policy. This observation raises broader questions about the conduct of macroeconomic stabilization policy. Does control over financial conditions rest exclusively with the central bank? And if the Treasury can influence long-term interest rates through its debt issuance decisions, is an independent central bank alone sufficient to maintain price stability? More broadly, our findings suggest that macroeconomic stabilization depends on the interaction between monetary policy and debt management. We leave these questions for future research.

References

Angeletos, George-Marios, Lian, Chen, and Wolf, Christian K (2025). "Fiscal Inaction as Monetary Support". *Working Paper*.

Bauer, Michael D and Rudebusch, Glenn D (2018). "The signaling channel for Federal Reserve bond purchases". *36th issue (September 2014) of the International Journal of Central Banking*.

Bauer, Michael D and Swanson, Eric T (2023). "A reassessment of monetary policy surprises and high-frequency identification". *NBER Macroeconomics Annual* 37.1, pp. 87–155.

Bernanke, Ben S (2022). *21st century monetary policy: The Federal Reserve from the great inflation to COVID-19*. WW Norton & Company.

Bi, Huixin, Phillot, Maxime, and Zubairy, Sarah (2025). "Treasury Supply Shocks: Propagation Through Debt Expansion and Maturity Adjustment". *Working Paper*.

Bianchi, Francesco, Faccini, Renato, and Melosi, Leonardo (2023). "A fiscal theory of persistent inflation". *The Quarterly Journal of Economics* 138.4, pp. 2127–2179.

Camara, Santiago, Christiano, Lawrence, and Dalgıc, Hüsnü (2025). "The international monetary transmission mechanism". *NBER Macroeconomics Annual* 39.1, pp. 65–140.

Chatterjee, Pratiti (2026). "Can Demand Shocks For Treasuries Inform Us About Monetary Policy?" *Working Paper*.

Christensen, Jens HE and Krogstrup, Signe (2019). "Transmission of quantitative easing: The role of central bank reserves". *The Economic Journal* 129.617, pp. 249–272.

Christiano, Lawrence J, Eichenbaum, Martin, and Evans, Charles L (2005). "Nominal rigidities and the dynamic effects of a shock to monetary policy". *Journal of political Economy* 113.1, pp. 1–45.

Cloyne, James, Ferreira, Clodomiro, Froemel, Maren, and Surico, Paolo (2023). "Monetary Policy, Corporate Finance, and Investment". *Journal of the European Economic Association* 21.6, pp. 2586–2634.

Correia, Isabel, Farhi, Emmanuel, Nicolini, Juan Pablo, and Teles, Pedro (2013). "Unconventional fiscal policy at the zero bound". *American Economic Review* 103.4, pp. 1172–1211.

D'Amico, Stefania, English, William, López-Salido, David, and Nelson, Edward (2012). "The Federal Reserve's large-scale asset purchase programmes: rationale and effects". *The Economic Journal* 122.564, F415–F446.

Droste, Michael, Gorodnichenko, Yuriy, and Ray, Walker (2024). "Unbundling quantitative easing: Taking a cue from treasury auctions". *Journal of Political Economy* 132.9, pp. 3115–3172.

Friedman, Milton (1959). *A program for monetary stability*. Ravenio Books.

Gagnon, Joseph, Raskin, Matthew, Remache, Julie, and Sack, Brian P (2011). "Large-scale asset purchases by the Federal Reserve: did they work?" *Economic Policy Review* 17.1, p. 41.

Garbade, Kenneth (2020). "Managing the Maturity Structure of Marketable Treasury Debt: 1953-1983". *FRB of New York Staff Report* 936.

Gertler, Mark and Karadi, Peter (2015). "Monetary policy surprises, credit costs, and economic activity". *American Economic Journal: Macroeconomics* 7.1, pp. 44–76.

Greenwood, Robin, Hanson, Samuel, Rudolph, Joshua S, and Summers, Lawrence H (2014). "Government debt management at the zero lower bound".

Greenwood, Robin, Hanson, Samuel G., Rudolph, Joshua S., and Summers, Lawrence H. (2015). *The $13 Trillion Question: Managing the U.S. Government's Debt*. Brookings Institution Press.

Greenwood, Robin and Vayanos, Dimitri (2014). "Bond supply and excess bond returns". *The Review of Financial Studies* 27.3, pp. 663–713.

Hanson, Samuel G and Stein, Jeremy C (2015). "Monetary policy and long-term real rates". *Journal of Financial Economics* 115.3, pp. 429–448.

Hartley, Jonathan and Rigon, Lorenzo (2024). "Does Government Debt Management Matter? High Frequency Identification From US Treasury Quarterly Refunding Announcements". *Working Paper*.

Houtz, Alex (2025). "How Government Debt Shocks Impact the Economy".

Jarociński, Marek and Karadi, Peter (2020). "Deconstructing monetary policy surprises—the role of information shocks". *American Economic Journal: Macroeconomics* 12.2, pp. 1–43.

Jiang, Zhengyang, Richmond, Robert J, and Zhang, Tony (2025). "Convenience lost". *National Bureau of Economic Research*.

Jordà, Òscar (2005). "Estimation and inference of impulse responses by local projections". *American economic review* 95.1, pp. 161–182.

Känzig, Diego R (2021). "The macroeconomic effects of oil supply news: Evidence from OPEC announcements". *American Economic Review* 111.4, pp. 1092–1125.

Kilian, Lutz (2024). "How to construct monthly VAR proxies based on daily surprises in futures markets". *Journal of Economic Dynamics and Control* 168, p. 104966.

Kim, Kyungmin, Laubach, Thomas, and Wei, Min (2023). "Macroeconomic effects of large-scale asset purchases: New evidence".

Krishnamurthy, Arvind and Vissing-Jorgensen, Annette (2011). *The effects of quantitative easing on interest rates: channels and implications for policy*. Tech. rep. National Bureau of Economic Research.

Leeper, Eric M (1991). "Equilibria under 'active'and 'passive'monetary and fiscal policies". *Journal of monetary Economics* 27.1, pp. 129–147.

Miran, Stephen and Roubini, Nouriel (2024). "ATI: Activist Treasury Issuance and the Tug of War over Monetary Policy". *Hudson Bay Capital*.

Miyamoto, Wataru, Nguyen, Thuy Lan, and Sergeyev, Dmitriy (2024). "How oil shocks propagate: Evidence on the monetary policy channel". Federal Reserve Bank of San Francisco.

Montiel Olea, José Luis and Plagborg-Møller, Mikkel (2021). "Local projection inference is simpler and more robust than you think". *Econometrica* 89.4, pp. 1789–1823.

Mustafi, Pal Utso (2025). "Deconstructing debt supply shocks using Treasury auction announcements". *Available at SSRN 4794463*.

Phillot, Maxime (2025). "US Treasury Auctions: A High-Frequency Identification of Supply Shocks". *American Economic Journal: Macroeconomics* 17.1, pp. 245–273.

Plagborg-Møller, Mikkel and Wolf, Christian K (2021). "Local projections and VARs estimate the same impulse responses". *Econometrica* 89.2, pp. 955–980.

Ramey, Valerie A (2016). "Macroeconomic shocks and their propagation". *Handbook of macroeconomics* 2, pp. 71–162.

Ramey, Valerie A and Zubairy, Sarah (2018). "Government spending multipliers in good times and in bad: evidence from US historical data". *Journal of political economy* 126.2, pp. 850–901.

Rogers, John H, Scotti, Chiara, and Wright, Jonathan H (2018). "Unconventional monetary policy and international risk premia". *Journal of Money, Credit and Banking* 50.8, pp. 1827–1850.

Sargent, Thomas J, Wallace, Neil, et al. (1981). “Some unpleasant monetarist arithmetic”. *Federal reserve bank of minneapolis quarterly review* 5.3, pp. 1–17.

Smets, Frank and Wouters, Rafael (2007). “Shocks and frictions in US business cycles: A Bayesian DSGE approach”. *American economic review* 97.3, pp. 586–606.

Swanson, Eric T (2021). “Measuring the effects of federal reserve forward guidance and asset purchases on financial markets”. *Journal of Monetary Economics* 118, pp. 32–53.

— (2023). *The Macroeconomic Effects of the Federal Reserve’s Conventional and Unconventional Monetary Policies*. Tech. rep. National Bureau of Economic Research.

Vayanos, Dimitri and Vila, Jean-Luc (2021). “A preferred-habitat model of the term structure of interest rates”. *Econometrica* 89.1, pp. 77–112.

Vissing-Jorgensen, Annette (2025). “Fluctuations in the Treasury General Account and their effect on the Fed’s balance sheet”. *Working Paper*.

Wiegand, Courtney (2025). “The effect of fiscal policy shocks on asset prices”. *Available at SSRN 5269517*.

Wolf, Christian K (2025). “Interest rate cuts versus stimulus payments: An equivalence result”. *Journal of Political Economy* 133.4, pp. 1235–1275.

Woodford, Michael (2001). “Fiscal Requirements for Price Stability”. *Journal of Money, Credit and Banking* 33.3, p. 669.

Wu, Jing Cynthia and Xia, Fan Dora (2016). “Measuring the macroeconomic impact of monetary policy at the zero lower bound”. *Journal of Money, Credit and Banking* 48.2-3, pp. 253–291.

Online Appendix

The Treasury Does Monetary Policy

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July, 2026

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A. Identification: background and sensitivity

In this Appendix, we provide additional details on the announcements used for identification. We also present a battery of diagnostic checks to verify that our surprise measures qualify as a valid shock series, following Ramey (2016).

A.1. Treasury policy announcements

There are two types of policy announcements related to debt issuance. The first one is the Quarterly Refunding Announcement—a quarterly statement with details on the next upcoming auctions together with general borrowing guidelines for the quarter. Figure A1 shows an excerpt from the Quarterly Refunding Announcement on August 1, 2018. Transcripts of the Quarterly Refunding Announcements are available on the Treasury's website.[19] The figure shows only the top of the page, which reports the total amount to be borrowed at the next auction, typically held about one week after the announcement.

August 1, 2018

WASHINGTON — The U.S. Department of the Treasury is offering $78 billion of Treasury securities to refund approximately $38.2 billion of privately-held Treasury notes maturing on August 15, 2018. This issuance will raise new cash of approximately $39.8 billion. The securities are:

- A 3-year note in the amount of $34 billion, maturing August 15, 2021;
- A 10-year note in the amount of $26 billion, maturing August 15, 2028; and
- A 30-year bond in the amount of $18 billion, maturing August 15, 2048.

The 3-year note will be auctioned on a yield basis at 1:00 p.m. ET on Tuesday, August 7, 2018. The 10-year note will be auctioned on a yield basis at 1:00 p.m. ET on Wednesday, August 8, 2018. The 30-year bond will be auctioned on a yield basis at 1:00 p.m. ET on Thursday, August 9, 2018. All of these auctions will settle on Wednesday, August 15, 2018.

Figure A1: Quarterly Refunding Announcement

The second type of announcement is the "intermediate announcement," that is, a single document released a few days before an individual auction.[20] As Figure A2 shows,

[19] See this link for the Treasury website: `https://home.treasury.gov/policy-issues/financing-the-government/quarterly-refunding/quarterly-refunding-archives/official-remarks-on-quarterly-refunding-by-calendar-year`.

[20] Documents for each individual auction announcement are available for download on the Treasury-

it reports both the release date (April 21, 2008) and the exact time stamp (11:00 A.M.). Importantly, it provides detailed information on the maturity offered (a 5-year note), the total amount to be issued ($19 billion), and the issue date (April 30, 2008).

PUBLIC DEBT NEWS

Department of the Treasury • Bureau of the Public Debt • Washington, DC 20239

TREASURY PUBLIC DEBT

Embargoed Until 11:00 A.M.
April 21, 2008

CONTACT: Office of Financing
202-504-3550

TREASURY OFFERING ANNOUNCEMENT[1]

Term and Type of Security	5-Year Note
Offering Amount	$19,000,000,000
Currently Outstanding	$0
CUSIP Number	912828HY9
Auction Date	April 24, 2008
Original Issue Date	April 30, 2008
Issue Date	April 30, 2008
Maturity Date	April 30, 2013
Dated Date	April 30, 2008
Series	K-2013
Yield	Determined at Auction
Interest Rate	Determined at Auction
Interest Payment Dates	October 31 and April 30
Accrued Interest from 04/30/2008 to 04/30/2008	None
Premium or Discount	Determined at Auction
Minimum Amount Required for STRIPS	$100
Corpus CUSIP Number	912820QV2
Additional TINT(s) Due Date(s) and CUSIP Number(s)	April 30, 2013 912833Z94
Maximum Award	$6,650,000,000
Maximum Recognized Bid at a Single Yield	$6,650,000,000
NLP Reporting Threshold	$6,650,000,000
NLP Exclusion Amount	$0
Scheduled Purchases in Treasury Direct	$26,000,000
Minimum Bid Amount and Multiples	$100
Competitive Bid Yield Increments[2]	0.001%
Maximum Noncompetitive Award	$5,000,000
Eligible for Holding in Treasury Direct	Yes
Eligible for Holding in Legacy Treasury Direct	Yes
Estimated Amount of Maturing Coupon Securities Held by the Public	$21,609,000,000
Maturing Date	April 30, 2008
SOMA Holdings Maturing	$5,228,000,000
SOMA Amounts Included in Offering Amount	No
FIMA Amounts Included in Offering Amount[3]	Yes
Noncompetitive Closing Time	12:00 Noon ET
Competitive Closing Time	1:00 p.m. ET

Figure A2: Intermediate announcement

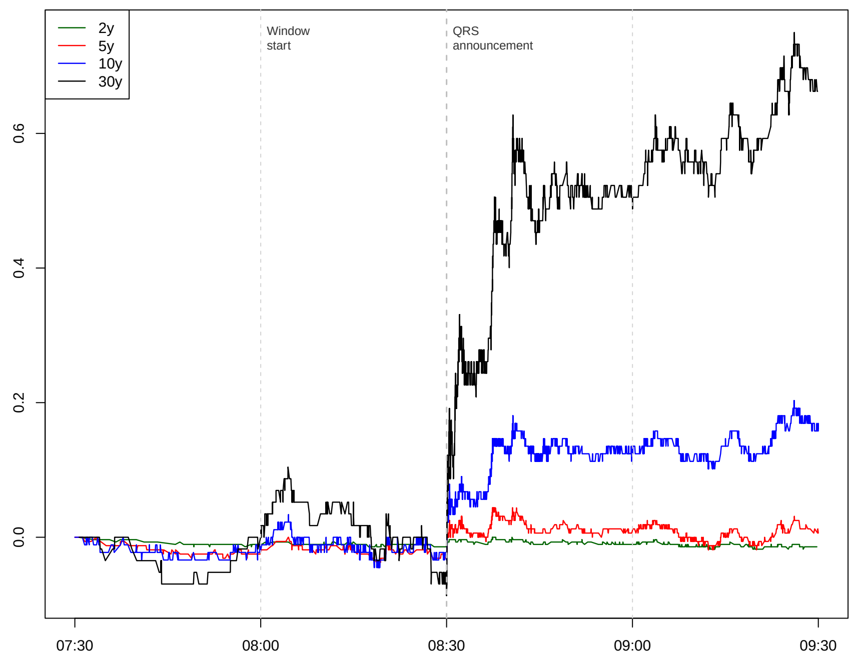
A.2. Treasury futures markets

Figure A3 shows the high-frequency market reaction to the Quarterly Refunding Announcement on May 6, 2020. The announcement was released at 8:30 A.M. (ET). The Treasury Department announced that it would issue $32 billion of 10-year notes and $22

Direct website at this link: https://www.treasurydirect.gov/auctions/announcements-data-results/announcement-results-press-releases/treasury-marketable/.

billion of 30-year bonds. This represented a relatively large increase compared to the first-quarter 2020 announcement, which took place on February 5, 2020, when the Treasury offered $27 billion of 10-year notes and $19 billion of 30-year bonds. In addition, Treasury officials explicitly stated that they planned "to increase long-term issuance." The market perceived this announcement as a surprise: the 30-year yield (computed from Treasury futures prices) jumped immediately after the release. Yields at the 10- and 5-year maturities also increased, although by a smaller magnitude.

Figure A3: High-frequency market reaction around May 6, 2020 QRS



Note: the graph shows high-frequency market reaction of the Treasury futures prices following the May 6, 2020, Quarterly Refunding Statement. The y-axis shows inverse log-price changes from 07:30 A.M.

A.3. Data Release

At times, a Treasury issuance announcement may coincide with other macroeconomic announcements. To the extent that these announcements are also closely monitored and affect market expectations, they could confound our surprise series. For this reason, we exclude all dates on which Treasury issuance announcements overlap with other major announcements. Table A1 lists the announcements we consider, along with their date ranges and the number of days on which they conflict with Treasury debt issuance announcements.

Table A1: Macroeconomic Data Releases

Announcement	Observations	Date	Frequency	Overlaps
GDP 1st release	111	1998M1-2025M7	Quarterly	14
New House Sales	205	2008M8-2025M9	Monthly	14
Durable Goods Orders	204	2008M10-2025M9	Monthly	10
ISM	334	1998M1-2025M10	Monthly	8
Government Deficit	333	1998M1-2025M9	Monthly	6
PCE	302	2000M8-2025M9	Monthly	4
FOMC	223	1998M5-2025M5	Six weeks	1
UoM	334	1998M1-2025M10	Monthly	1
CB Confidence Index	193	2009M9-2025M9	Monthly	0
CPI	333	1998M1-2025M9	Monthly	0
Consumer Credit	334	1998M1-2025M10	Monthly	0
GDP 2nd release	111	1998M2-2025M8	Quarterly	0
GDP 3rd release	111	1998M3-2025M9	Quarterly	0
Housing Start	331	1998M1-2025M9	Monthly	0
IPI	333	1998M1-2025M9	Monthly	0
PPI	140	2014M2-2025M9	Monthly	0
Retail Sales	292	2001M6-2025M9	Monthly	0
Unemployment	333	1998M1-2025M9	Monthly	0

Note: The table shows information on major U.S. macroeconomic news announcements and the number of instances in which they overlap with QRS or auction announcements.

A.4. Treasury policy shock: diagnostic checks

Autocorrelation. As a first diagnostic check of our surprise series, we verify that the shock does not exhibit autocorrelation (Ramey, 2016). Figures A4 and A5 show the autocorrelation functions for the daily and monthly surprise series, respectively. Both figures display only mild correlations at lags between 10 and 14. In addition, due to our aggregation procedure, the monthly series exhibits a strong correlation at the first lag. In all regressions, we control for lags of the shock; doing so does not materially affect our results.

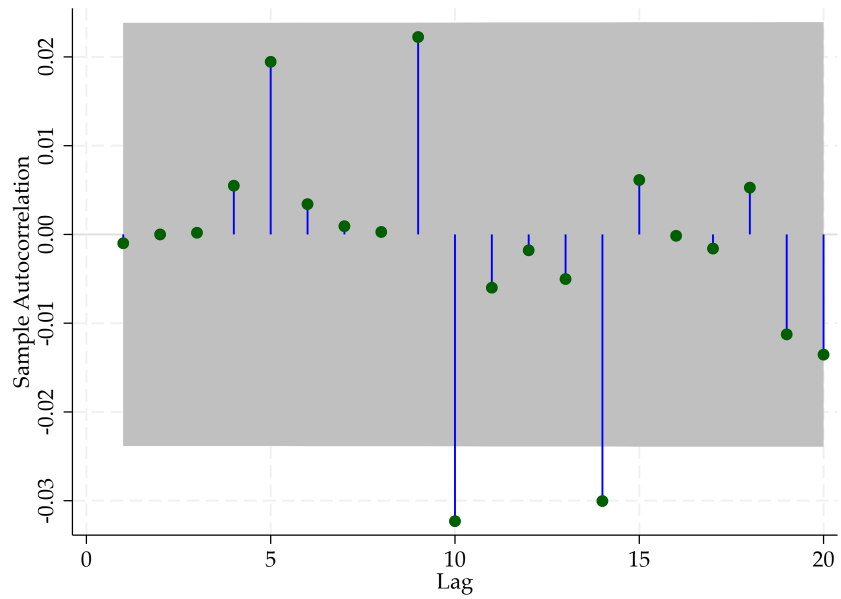


Figure A4: Daily autocorrelation function of Treasury policy shock

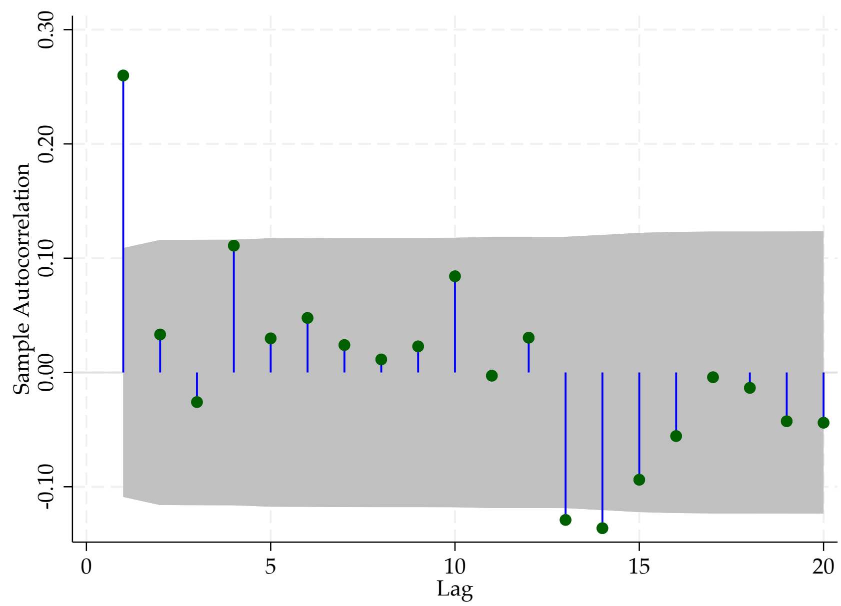


Figure A5: Monthly autocorrelation function of Treasury policy shock

Shock correlation. We further verify that our shock is not correlated with other identified macroeconomic shocks. Table A2 shows that, by and large, our shock is uncorrelated with alternative macroeconomic shock measures. In particular, it is important that our shock series is not correlated with the Treasury demand shock from Droste, Gorodnichenko, and Ray (2024), given that our identifying assumption is that demand for Treasuries is fixed in the narrow window around the supply announcement.

Table A2: Correlation with other identified shocks

Shock	Source	ρ	p-value	n	Sample
Panel A: Oil shocks					
Price	Hamilton (2003)	0.06	0.40	234	1998M2-2017M12
Supply	Kilian (2008)	0.05	0.58	114	1998M2-2007M12
	Caldara, Cavallo, and Iacoviello (2019)	0.06	0.36	210	1998M2-2015M12
	Känzig (2021)	-0.07	0.21	306	1975M1-2023M12
Demand	Kilian (2009)	-0.02	0.86	114	1998M2-2007M12
Panel B: Monetary policy shocks					
Raw	Bauer and Swanson (2023)	-0.08	0.18	306	1988M2-2023M12
Orth	Bauer and Swanson (2023)	-0.02	0.78	306	1988M2-2023M12
	Gertler and Karadi (2015)	-0.10	0.12	222	1998M2-2016M12
Panel C: Fiscal policy shocks					
	Romer and Romer (2010)	-0.21	0.20	38	1998Q3-2007Q4
	Fisher and Peters (2010)	0.09	0.58	42	1998Q3-2008Q4
	Ramey and Zubairy (2018)	-0.08	0.53	70	1998Q3-2015Q4
Panel D: Treasury demand shocks					
	Ray, Droste, and Gorodnichenko (2024)	0.00	0.97	234	1995M2-2017M12
Panel E: Financial shocks					
	Gilchrist and Zakrajsek (2012)	0.06	0.42	210	1998M2-2015M12
	Bassett et al. (2014)	0.13	0.37	50	1998Q3-2010Q4
Panel F: News shocks					
	Barsky and Sims (2011)	0.06	0.73	37	1998Q3-2007Q3
	Kurmann and Otrok (2013)	0.16	0.40	28	1998Q3-2005Q2
	Beaudry and Portier (2014)	-0.16	0.23	57	1998Q3-2012Q3
Panel G: Uncertainty shocks					
	Bloom (2009)	0.06	0.37	234	1998M2-2017M12
	Baker, Bloom, and Davis (2016)	-0.10	0.12	234	1998M2-2017M12
Panel H: Productivity shocks					
	Basu, Fernald, and Kimball (2006)	0.13	0.36	54	1998Q3-2011Q4
	Smets and Wouters (2007)	0.03	0.88	26	1998Q3-2004Q4

Note: The table shows the correlation of the Treasury policy shock series with different shock measures from the literature.

Granger test. We also examine the forecastability of our shock series. We conduct Granger causality tests at both the daily and monthly frequencies and find that the shock series is not forecastable using past macroeconomic and financial variables (Table A3).

Table A3: Granger causality results

Panel A: Daily frequency

Variable	p-value
3M T-bill	0.7023
2Y Treasury	0.4885
5Y Treasury	0.4494
10Y Treasury	0.3381
30Y Treasury	0.6932
Term premium 2Y	0.4967
Term premium 3Y	0.5848
Term premium 5Y	0.2530
Term premium 10Y	0.2622
Breakeven 2Y	0.7517
Breakeven 5Y	0.9564
Breakeven 10Y	0.9105
AAA	0.6918
VIX	0.1014
WAM	0.6212

Panel B: Monthly frequency

Variable	p-value
3M T-bill	0.0183
2Y Treasury	0.2348
5Y Treasury	0.4150
10Y Treasury	0.4595
30Y Treasury	0.8420
Term premium 2Y	0.1759
Term premium 3Y	0.1764
Term premium 5Y	0.1799
Term premium 10Y	0.1836
Breakeven 2Y	0.2137
Breakeven 5Y	0.7869
Breakeven 10Y	0.9096
AAA	0.8791
VIX	0.1087
WAM	0.0842
CPI	0.1585
GDP	0.3876
Industrial production	0.5736

Note: The table reports the p-values from Granger causality tests of our Treasury policy shock series. We conduct the tests at both the daily (Panel A) and monthly (Panel B) frequencies. We examine whether a set of macroeconomic and financial variables Granger-cause the shock series. We include a constant term and set the lag order to six lags at the monthly frequency and five lags at the daily frequency.

Predictability exercise. In the monetary policy literature, high-frequency surprises have been shown to be predictable using past macroeconomic and financial news (Nakamura and Steinsson, 2018; Miranda-Agrippino and Ricco, 2021; Bauer and Swanson, 2023). This finding raises concerns that such surprise series may be endogenous and therefore may not qualify as true economic shocks. Following Bauer and Swanson (2023), we examine whether our surprises can be predicted by macroeconomic and financial news available prior to the announcement. To this end, we construct a daily dataset of "news" releases occurring before Treasury policy announcements and restrict the analysis to days on which a Treasury policy announcement is released.

We include the surprise in nonfarm payrolls; the three-month changes in the slope of the yield curve, the S&P 500, and the Bloomberg Commodity Spot Price Index; an index of Treasury skewness from Bauer and Chernov (2024); and employment growth over the previous twelve months. These are the same regressors used by Bauer and Swanson (2023). We consider three different sample periods. Column (1) uses the full sample; column (2) restricts the sample to the baseline analysis period; and column (3) excludes the COVID years.

Table A4 shows that the three-month changes in the slope of the yield curve and in the commodity price index are significantly correlated with the surprises. However, the R^2 is extremely low, ranging between 2.6 and 3.2%. This stands in sharp contrast to the monetary policy literature, where the same regression explains between 16 and 24% of the variation in monetary policy surprises. Below, we show that our results are unchanged when we residualize the surprise series with respect to these news variables.

Table A4: Predictability of Treasury policy surprises

	(1)	(2)	(3)
Nonfarm Payroll	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.001)
Empl. growth (12m)	-0.931	-1.461	-5.566
	(2.541)	(2.564)	(6.384)
Δ Slope (3m)	0.410**	0.474**	0.377**
	(0.185)	(0.201)	(0.192)
Δ log S&P 500 (3m)	1.146	0.911	1.278
	(1.320)	(1.496)	(1.447)
Δ log comm. price (3m)	-3.043**	-3.277**	-3.178**
	(1.260)	(1.385)	(1.377)
Treasury skewness	-0.064	-0.101	-0.050
	(0.196)	(0.199)	(0.216)
Constant	0.065	0.115	0.119
	(0.092)	(0.097)	(0.131)
R^2	0.026	0.032	0.027
Period	1998/7/21–2025/6/3	2003/7/21–2025/6/3	Excl. 2020/2/1–2021/12/31
N	587	524	527

Note: The table replicates equation (14) in Bauer and Swanson (2023). In particular, given the Treasury policy surprise tps_t at any time t, we estimate the regression: $tps_t = \alpha + \beta' X_{t-} + u_t$. Predictors X are observed prior to the Treasury policy announcements: the surprise component of the most recent nonfarm payrolls release, the log change in the S&P 500 index from 3 months before to the day before the Treasury announcement, the change in the yield curve slope over the same period, the log change in a commodity price index over the same period, the implied skewness of the 10-year Treasury yield computed by Bauer and Chernov (2024) averaged over the preceding month, the log change in nonfarm payroll employment from one year earlier to the most recent release. Heteroskedasticity-consistent standard errors are in parentheses. The third column Excl. 2020/2/1-2021/12/31 excludes the COVID years from our full sample of 1998/7/21 to 2025/6/3.

A.5. Second principal component

In this section, we report and discuss the results for the second principal component. To our knowledge, two papers in the literature attempt to decompose high-frequency surprises around Treasury debt issuance announcements into a “level” shock—affecting the overall size of debt issuance without altering its composition—and a “maturity” shock, which changes the structure of issuance across maturities while leaving the total amount of public debt unchanged.

Mustafi (2025) relies on a combination of narrative and heteroskedasticity-based identification to separate these two shocks. Bi, Phillot, and Zubairy (2025) is closer to our empirical setting: they extract principal components from high-frequency surprises in 2-, 5-, 10-, and 30-year Treasury futures and subsequently rotate these components to obtain a structural interpretation.

We focus on the second principal component and study the impulse responses of the yield curve and of the maturity structure to shed light on the nature of the shock. We consider the component shown in Table 1, multiplied by -1, so that it corresponds to an upward-sloping yield curve. Figure A6 shows the response of the weighted average maturity to a second principal component shock. Although noisy, the maturity structure shrinks.

This impulse response is puzzling when considered alongside Figure A7, which shows the contemporaneous yield curve response to the second principal component. Although the maturity structure contracts,[21] longer-term yields (from the five-year maturity onward) increase on impact.

Overall, these results point to a puzzling relationship between changes in the maturity structure and the yield curve response. Since we cannot assign a structural interpretation to the second principal component, we focus on the first as a way to summarize the informational content contained in Treasury debt issuance announcements.

[21] We verified that, in response to this shock, the amount of long-term debt declines, even though responses are noisy.

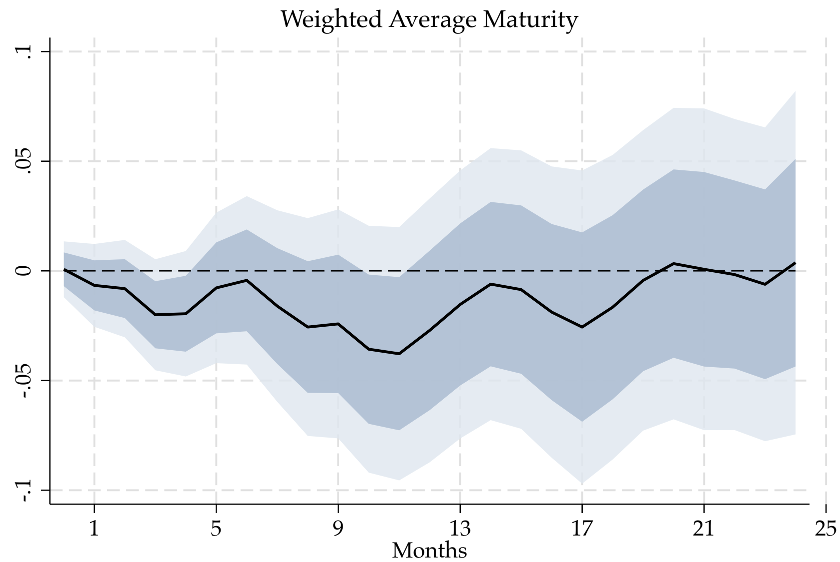


Figure A6: Weighted average maturity response to PC2

Note: this figure shows the results of estimating equation (3), with the shock being the second principal component as shown in Table 1. The graph shows the response of the weighted average maturity. The x-axis shows months from the shock, while the y-axis shows the response in years. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

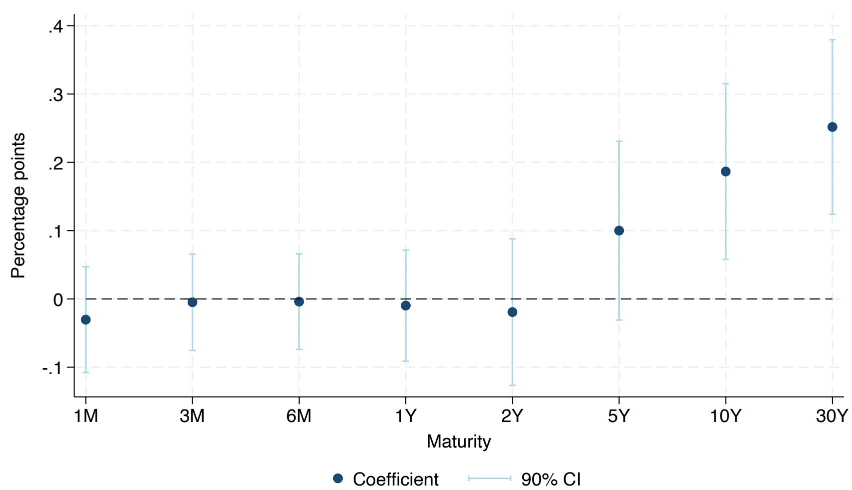


Figure A7: Yield curve impact response to PC2

Note: this figure shows the impact response of Treasury rates on the day of the shock to the second principal component. The x-axis shows the maturity of each rate, while the y-axis shows the response in percentage points. The blue dots represent the point estimates, while light blue bars represent 90% heteroskedasticity-robust confidence intervals.

B. Data

In this Appendix, we provide details on the data we use in the analysis. Macro and financial data come from FRED, Bloomberg and Refinitiv. High-frequency data are taken from the LSEG Tick History database. Data on Treasury variables (outstanding debt, weighted average maturity) has been obtained from the FiscalData Treasury Gov. website.[22] Data on investors' expectations about the U.S. budget balance has been obtained from the Survey of Professional Forcasters. Finally, data on the Federal Reserve's balance sheet has been downloaded from the New York Fed website.[23]

Table B1: Data and Sources

Variable	Description	Source
Intradaily data.		
Treasury futures	Tick-data for U.S. Treasury futures at 2, 5, 10, and 30-year maturities [TUc1, FVc1, TYc1, USc1]	LSEG Tick History
Daily data.		
Treasury bond yields	Yields on U.S. Treasury securities at constant maturity	Refinitiv
Corporate bond yields	AAA and BAA Corporate Bond Yields	FRED
Term premia	Term Premium on 1-, 2-, 3-, 5-, and 10-Year Zero-Coupon Treasury Bonds	FRED
VIX	CBOE Volatility Index	FRED
S&P 500 Index	Stock market index	Bloomberg
Inflation Expectations	Breakeven Inflation Expectations	FRED
Total Debt	U.S. total marketable debt	U.S. Treasury and own calculations
Treasury Skewness	Implied skewness of the 10-year Treasury yield	Bauer and Chernov (2024)
Macroeconomic and financial news	"News" used for the predictability exercise	Bloomberg and FRED
Monthly data.		

Continued on next page

[22]The datasets are available at this link: https://fiscaldata.treasury.gov/datasets/.
[23]The dataset is available at this link: https://www.newyorkfed.org/markets/soma-holdings.

Table B1 – Continued

Variable	Description	Source
SOMA holdings	System Open Market Account Holdings of Domestic Securities	New York Fed and own calculations
Consumer Price Index	CPI for all urban consumers: all items	FRED
Consumption	Personal Consumption Expenditure	FRED
Industrial Production	Industrial production index	FRED
Investment	Manufacturers' Value of Shipments: Non-defense Capital Goods	FRED
Shadow rate	Shadow rate from Wu and Xia (2016)	Atlanta Fed
EBP	Excess bond premium from Gilchrist and Zakrajsek (2012)	Gilchrist's web-page
NFCI	National Financial Conditions Index	Chicago Fed web-site
Short-term debt	Treasuries with maturities at issuance of one year or lower	U.S. Treasury
Long-term debt	Treasuries with maturities at issuance of two years or greater	U.S. Treasury
WAM	Weighted Average Maturity of marketable debt	U.S. Treasury
WAD	Weighted Average Duration of marketable debt	U.S. Treasury and own calculations
Quarterly data.		
Government Expenditures	Total federal government expenditure	FRED
Government Tax Receipts	Total federal government tax receipts	FRED
Government Interest Expenditures	Total federal governemnt interest expenses	FRED
GDP	Gross Domestic Product	FRED

C. Additional results and robustness checks

This Appendix shows additional results not shown in the main text, along with a battery of robustness checks.

C.1. Debt response

Figure C1 shows the monthly response of total public debt to a 10–basis point exogenous increase in the five-year yield. The results indicate that a *Treasury policy shock* corresponds to an unanticipated change in the total amount of debt issued.[24] Figure C2 shows that the increase is even more persistent if one focuses only on bills, notes and bonds. Figure C3 confirms that this result is robust to alternative definitions of public debt. In particular, we consider the debt-to-GDP ratio and debt deflated by the GDP deflator. The results are unchanged.

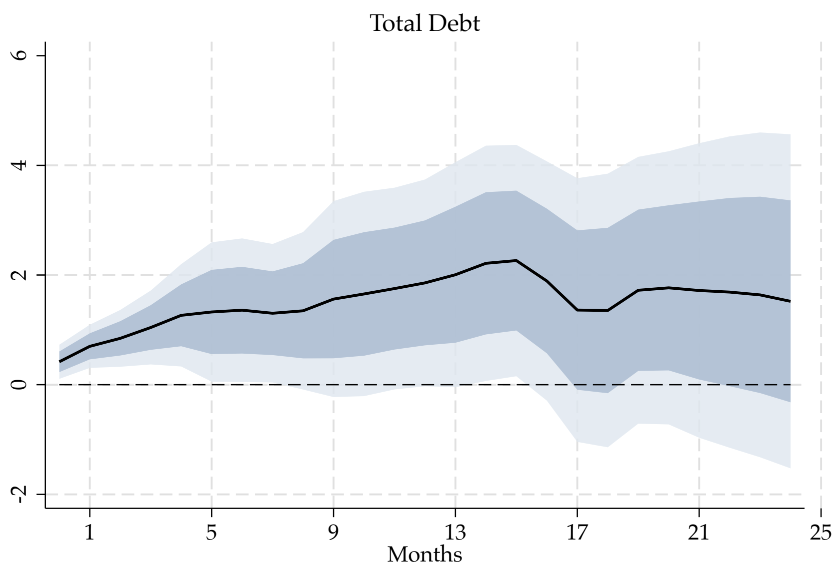


Figure C1: Impulse response of debt to a Treasury policy shock

Note: this figure shows the results of estimating equation (3), with the y variable being total U.S. public debt outstanding. The x-axis shows months from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

[24] As shown in Figure 3, this increase spans the entire maturity spectrum.

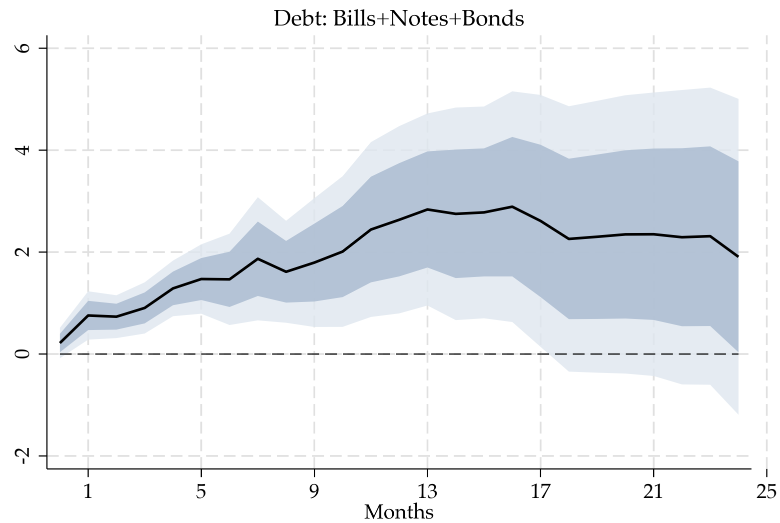


Figure C2: Impulse response of debt to a Treasury policy shock

Note: this figure shows the results of estimating equation (3), with the y variable being U.S. public debt outstanding as the sum of Treasury bills, notes, and bonds. The x-axis shows months from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

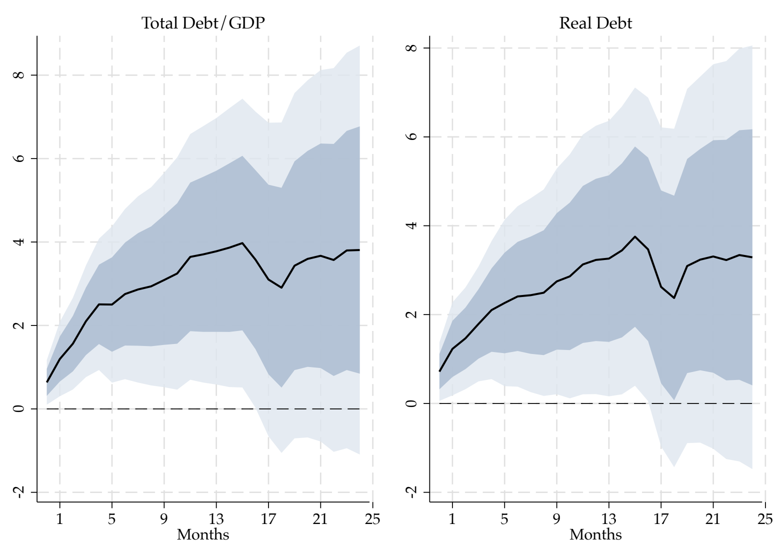


Figure C3: Other definitions of U.S. public debt

Note: this figure shows the results of estimating equation (3). The left graph shows total debt over GDP; the right graph shows total debt deflated with the GDP deflator. The x-axis shows months from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

We further show that our shock measure predicts a large increase of the TGA. This is consistent with the Treasury exercising discretion over the size of the cash account it holds at the Fed—a source of exogenous variation that is reflected in our high-frequency shock measure.

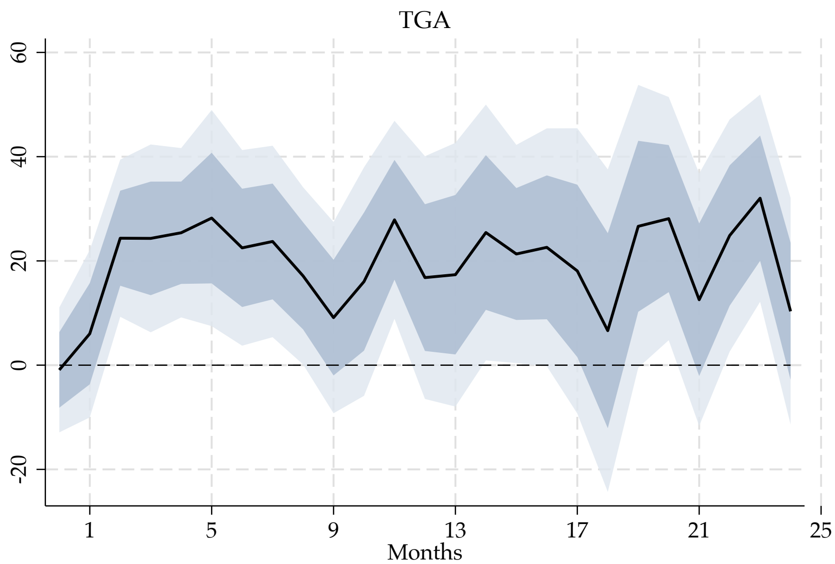


Figure C4: Treasury General Account

Note: this figure shows the results of estimating equation (3). The graph shows the Treasury General Account response to the shock. The x-axis shows months from the shock, while the y-axis shows the response in percentage terms. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

We also explore the extent to which our shock increases duration risk in the market. Figure C5 shows that the duration-weighted debt-to-GDP ratio (in 10-year equivalents) rises considerably in response to our shock. Potentially, this could be partially be due to an increase in the maturity structure. We therefore explore the response of the weighted average maturity (WAM) and duration (WAD), computed, respectively, as

$$WAM = \frac{\sum_i FV_i * M_i}{\sum_i FV_i} \tag{10}$$

$$WAD = \frac{\sum_i FV_i * D_i}{\sum_i FV_i} \tag{11}$$

where FV_i is the face value of security i, M_i is the residual maturity and D_i denotes the duration. Figure C6 shows that the shock leads to only a very mild decline in these measures, which is rarely statistically different from zero. Taken together, Figures C5 and C6 indicate that our shock primarily captures news about the total amount of public debt outstanding, rather than changes in its maturity composition. In other words, the increase in duration risk supplied to the market arises because more debt is issued across the maturity spectrum, not because the Treasury lengthens the maturity structure of its debt.

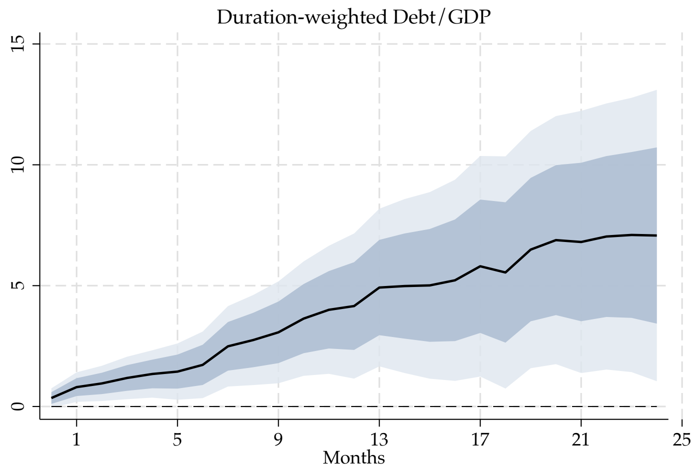


Figure C5: Duration-weighted debt-to-GDP in 10-year equivalents

Note: this figure shows the results of estimating equation (3). The graph shows the duration-weighted debt-to-GDP in 10-year equivalents, following the approach by Greenwood et al. (2014). The x-axis shows months from the shock, while the y-axis shows the response in percent. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

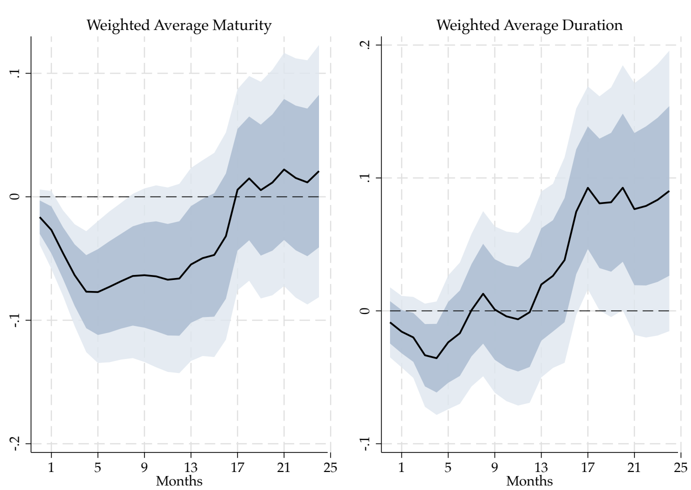


Figure C6: Maturity and Duration

Note: this figure shows the results of estimating equation (3). The left graph shows the weighted average maturity of U.S. public debt; the right graph shows the weighted average duration of U.S. public debt. The x-axis shows months from the shock, while the y-axis shows the response in years. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

We also demonstrate that our shock is distinct from a traditional "fiscal shock," which captures news about government taxes and spending. To do so, we aggregate the shock to the quarterly frequency using again the methodology by Gertler and Karadi (2015), and study the response of fiscal variables. Figure C7 shows that federal government expenditures net of interest payments remain essentially unchanged over a two-year horizon following the shock. Tax revenues decline modestly, broadly mirroring the dynamics of industrial production. The only economically meaningful response is observed in federal interest expenditures, which increase persistently over time.

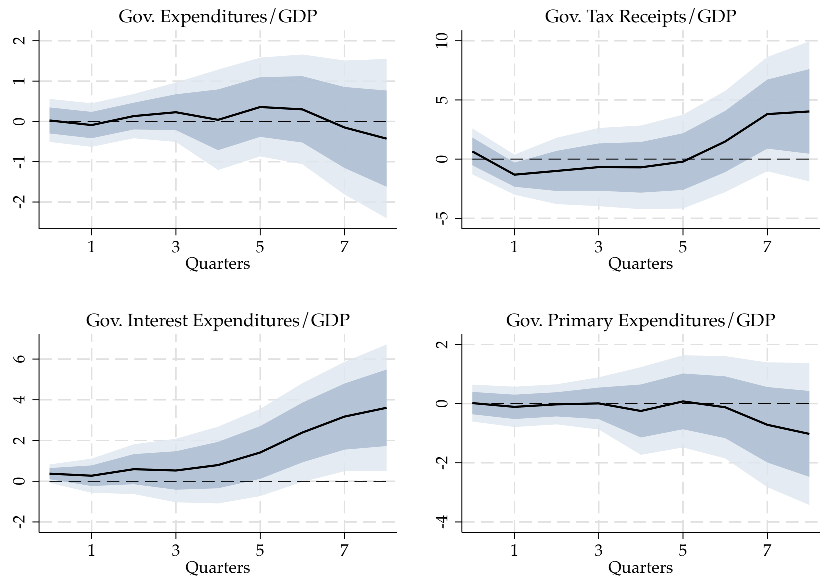


Figure C7: Government expenditures and tax receipts

Note: this figure shows the results of estimating equation (3). The top-left graph shows total federal government expenditures over GDP; the top-right graph shows total federal tax receipts over GDP; the bottom-left graph shows federal government interest expenditures over GDP; the bottom-right graph shows the government primary expenditures (net of interest payments) over GDP. The x-axis shows quarters from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

C.2. Financial and macroeconomics effects

Additional results. We begin by presenting additional financial results. Figure C8 shows the dynamic response of Treasury yields over a 16-day window. It confirms the finding in Figure 4 that short-term rates are largely unaffected by the shock, while long-term yields increase substantially. Figure C9 further shows that a large fraction of the increase in long-term yields is driven by an increase in term premia. Finally, Figure C10 shows that the pass-through from Treasury yields to corporate bond yields is very high, at around 90%.

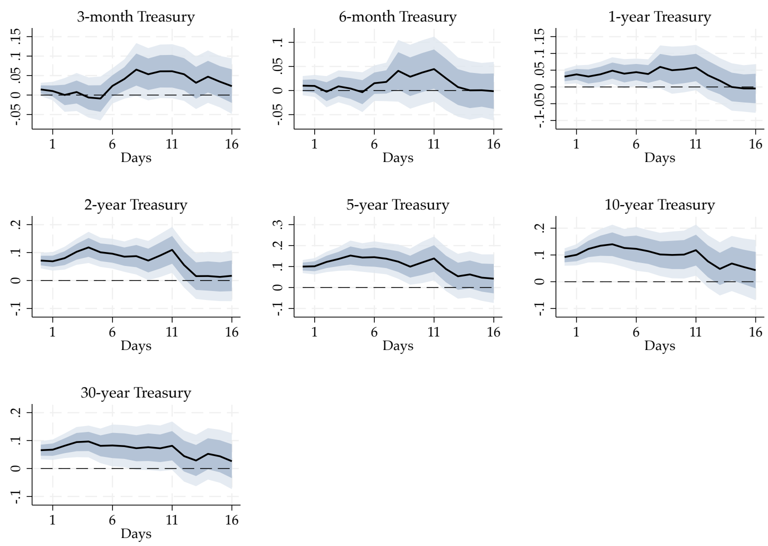


Figure C8: Treasury rates dynamic response

Note: this figure shows the results of estimating equation (3). All the panels show the response of Treasury rates, from maturity of three months to thirty years. The x-axis shows days from the shock, while the y-axis shows the response in percentage points. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

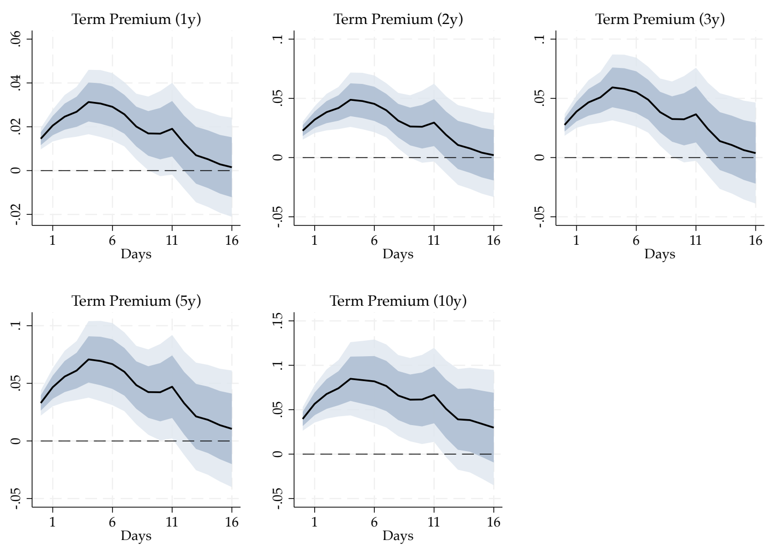


Figure C9: Term premia

Note: this figure shows the results of estimating equation (3). All the panels show the response of term premia, from maturity of one year to ten years. The x-axis shows days from the shock, while the y-axis shows the response in percentage points. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

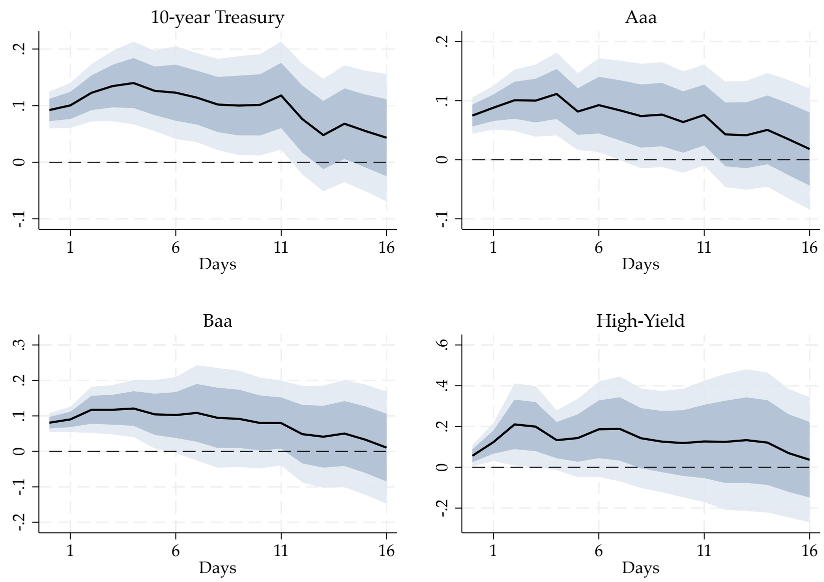


Figure C10: Spillover to corporate yields

Note: this figure shows the results of estimating equation (3). The upper-left panel shows the response of the ten-year Treasury yield; the upper-right panel shows the response of Aaa corporate yield (which is an index pooling together corporate bonds of maturity of twenty years or longer); the bottom-left panel shows the response of Baa corporate yield; the bottom-right panel the response of the High-yield corporate yield. The x-axis shows days from the shock, while the y-axis shows the response in percentage points. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

We also examine whether our shock affects broader financial markets. This is particularly important given the emphasis, in the high-frequency literature, on information effects (Jarociński and Karadi, 2020). Figure C11 shows that equity prices do not respond to a Treasury policy shock. One possible interpretation is that these announcements are primarily monitored by a specific group of investors—namely, bond traders—whose information set may differ from that of equity market participants. We also study whether inflation rates respond to the news conveyed by debt issuance announcements. Figure C12 shows that break-even inflation expectations computed from TIPS do not respond significantly to these announcements. This finding is consistent with the view that information about taxes and spending is already incorporated into financial markets at the time of the announcement, since the Treasury takes fiscal needs as given when deciding how to finance federal spending.

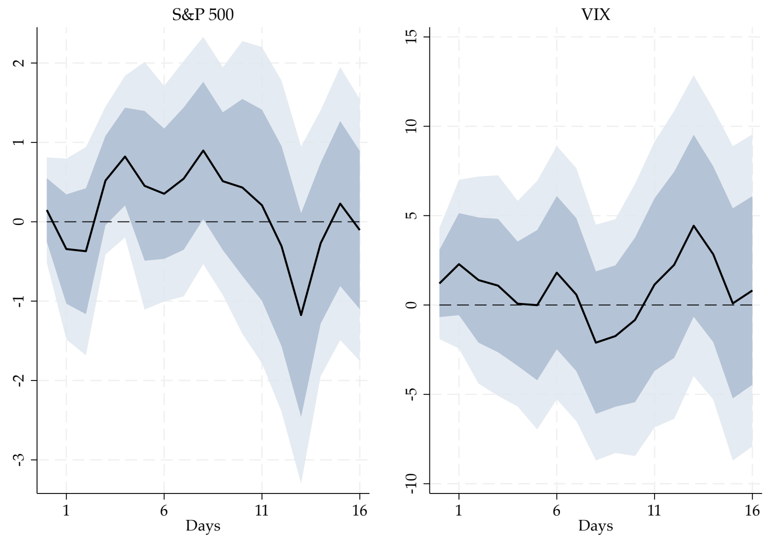


Figure C11: Stock market response

Note: this figure shows the results of estimating equation (3). The left panel shows the response of the S&P 500 Index; the right panel shows the response of the CBOE Volatility Index (VIX). The x-axis shows days from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

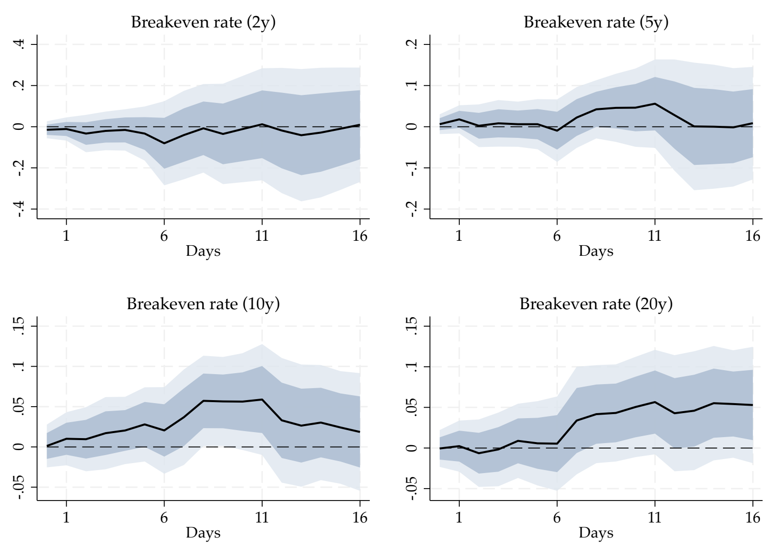


Figure C12: Inflation expectations response

Note: this figure shows the results of estimating equation (3). The panels show the break-even inflation rate for different maturities computed using TIPS. The x-axis shows days from the shock, while the y-axis shows the response in percentage points. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

Moving to the monthly analysis, Figure C13 shows the response, at the monthly frequency, of the five-year Treasury yield to a Treasury policy shock. This graph confirms the daily analysis and further shows that the shock corresponds to a persistent increase in long-term rates.

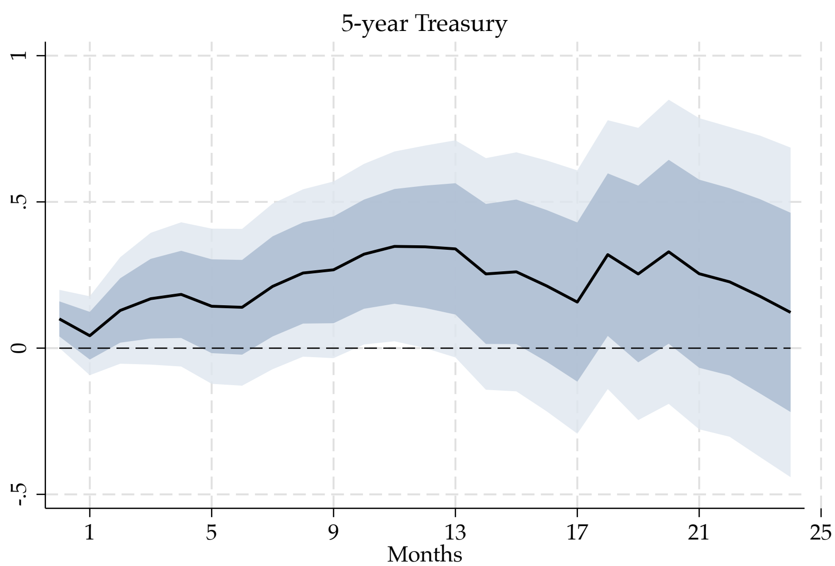


Figure C13: Treasury yield response

Note: this figure shows the results of estimating equation (3). The figure shows the response of the five-year Treasury yield. The x-axis shows months from the shock, while the y-axis shows the response in percentage points. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

Figure 5 shows our headline result: Treasury policy shocks act as a contractionary shock on the economy. Figure C14 reinforces this finding: even though estimates are imprecise, the unemployment rate increases and durable consumption drops. Notably, the response of unemployment is small in size.

Finally, Figure C15 shows that the larger-than-expected debt issuance acts as a tightening of financial conditions. Broad measures of financial and credit risk rise following the shock, thereby causing a drop in investment and consumption.

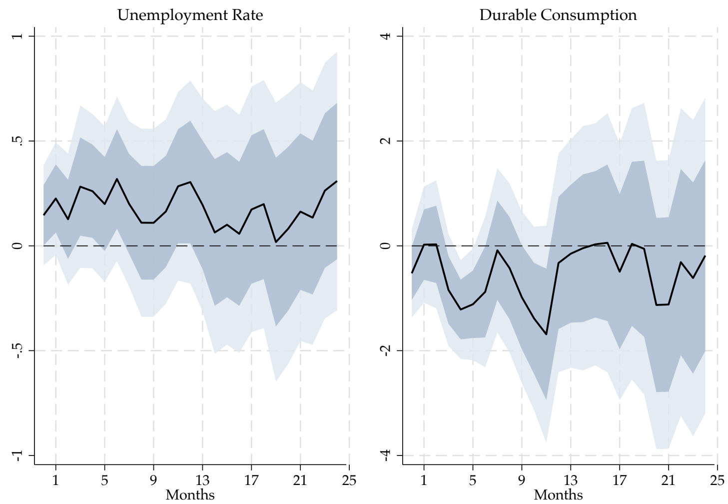


Figure C14: Other macroeconomic responses

Note: this figure shows the results of estimating equation (3). The the left graph shows the unemployment rate; the right graph shows durable consumption. The x-axis shows months from the shock, while the y-axis shows the response in percentage points (percent) in the left (right) graph. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

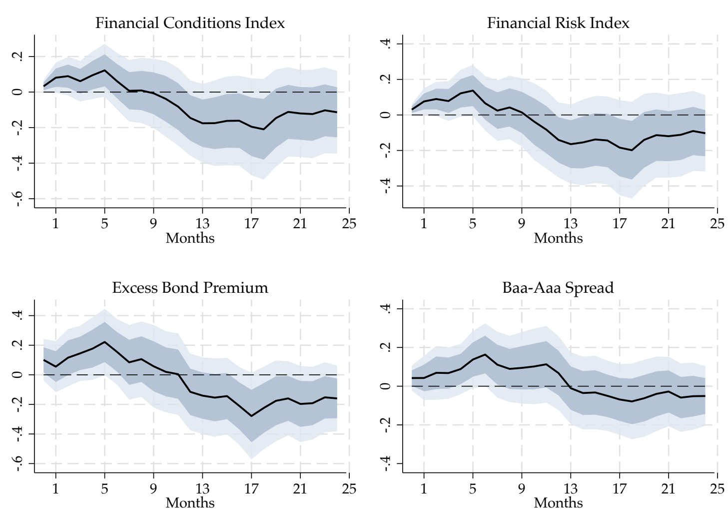


Figure C15: Financial conditions response

Note: this figure shows the results of estimating equation (3). The upper-left panel shows the response of the National Financial Conditions Index from the Chicago Fed; the upper-right panel shows its sub-index focused on risk; the bottom-left panel shows the Excess Bond Premium (Gilchrist and Zakrajsek, 2012); the bottom-right panel shows the Baa-Aaa spread, a measure of risk premium. The x-axis shows months from the shock, while the y-axis shows the response in percentage points. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% robust confidence intervals.

Robustness checks. We run a battery of robustness checks for Figures 4 and 5. Although not shown, we verify that the same robustness checks also apply to Figures 2 and 3. In particular, we consider alternative sets of controls (Figures C17 and C21), different sample periods (Figures C18 and C22), different lag structure (Figures C19 and C20), and we test for pre-trends in the monthly local projections (Figure C23).

We also assess the importance of influential observations in our shock series. To do so, we perform a jackknife exercise. We censor one shock value at a time to zero, and re-estimate the local projection. Further, we include a dummy variable for the month we censor, to account for the differential impact on the controls. Results in Figure C24 show that results are not driven by any single shock. When censoring some shocks, we can get a bigger impact, especially on industrial production or investment. Sometimes, the effect gets attenuated, especially for consumption.

Overall, these robustness checks indicate that our results are not sensitive to specific choices of controls, samples, or lag structure, are not driven by pre-trends, and are not driven by influential observations in our shock series.

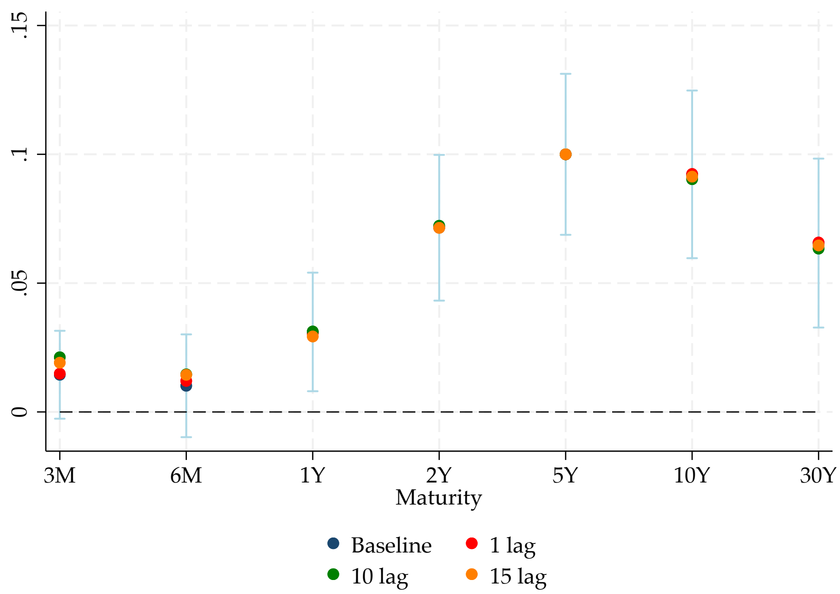


Figure C16: Different lags

Note: this figure replicates Figure 4, but changes the number of lags of the controls and of the shock.

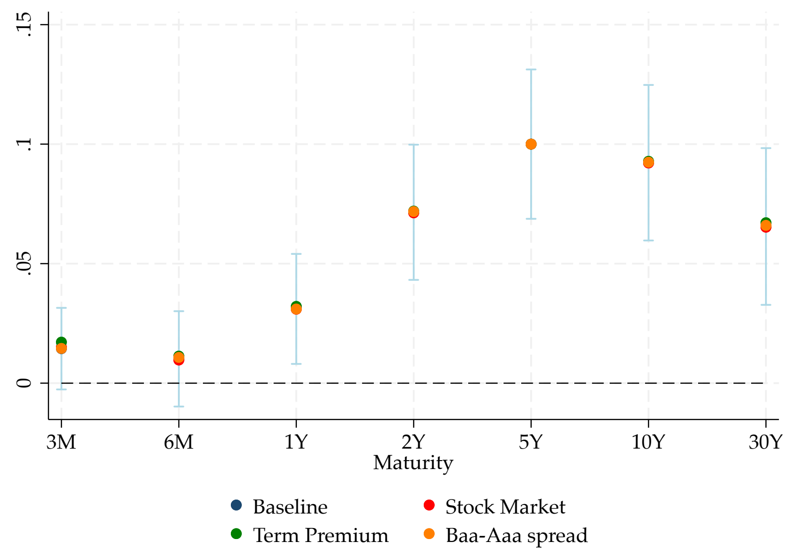


Figure C17: Different controls

Note: this figure replicates Figure 4, but adds controls to the specification. The stock market variables are the S&P 500 and VIX. The term premium is the five-year term premium.

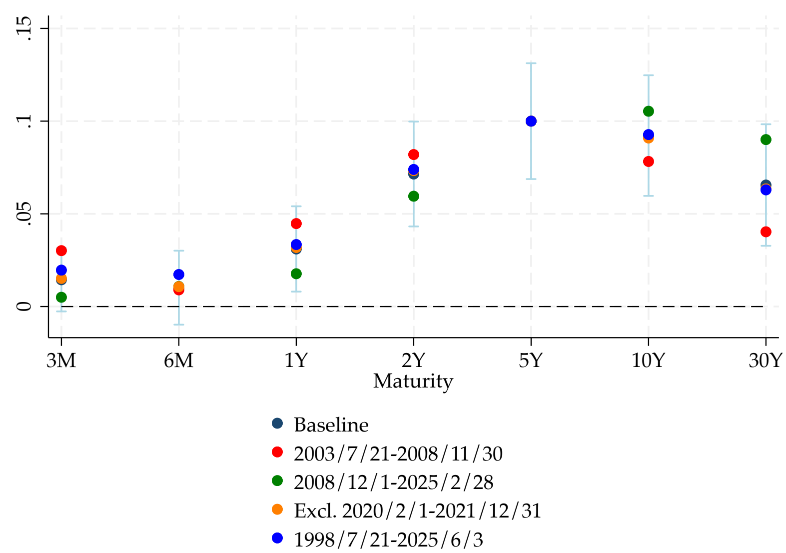


Figure C18: Different sample periods

Note: this figure replicates Figure 4, but changes the sample periods.

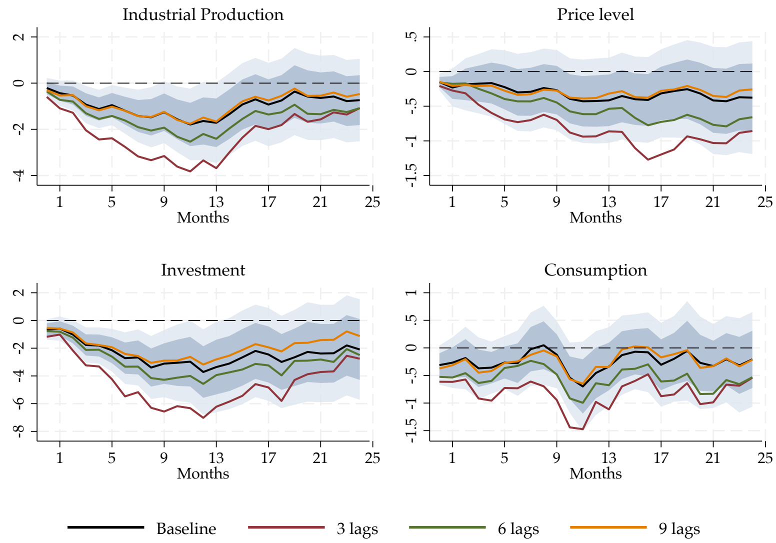


Figure C19: Different lags

Note: this figure replicates Figure 5, but changes the number of lags of controls and of the shock at the same time. The lines correspond to point estimates.

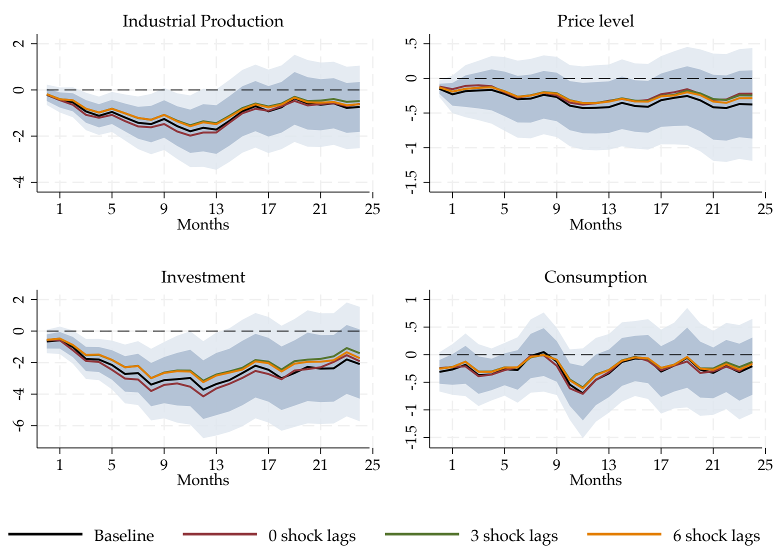


Figure C20: Different lags of the shock

Note: this figure replicates Figure 5, but changes the number of lags only of the shock. The lines correspond to point estimates.

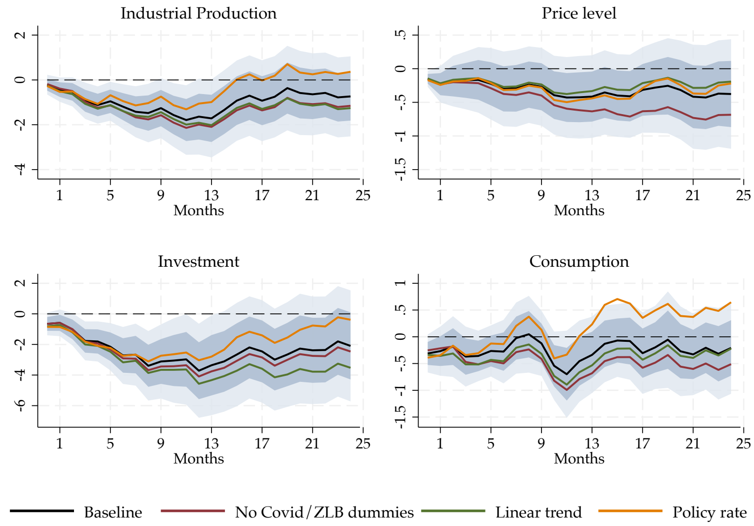


Figure C21: Different controls

Note: this figure replicates Figure 5, but changes the set of controls. The lines correspond to point estimates. The policy rate is the federal funds rate outside the ZLB period, and the shadow federal funds rate calculated by using the method of Wu and Xia (2016) during the ZLB period. The latter is defined as months when the federal funds rate was at or below 0.5. The Covid dummy is set to 1 in months 2020:M2 to 2020:M12.

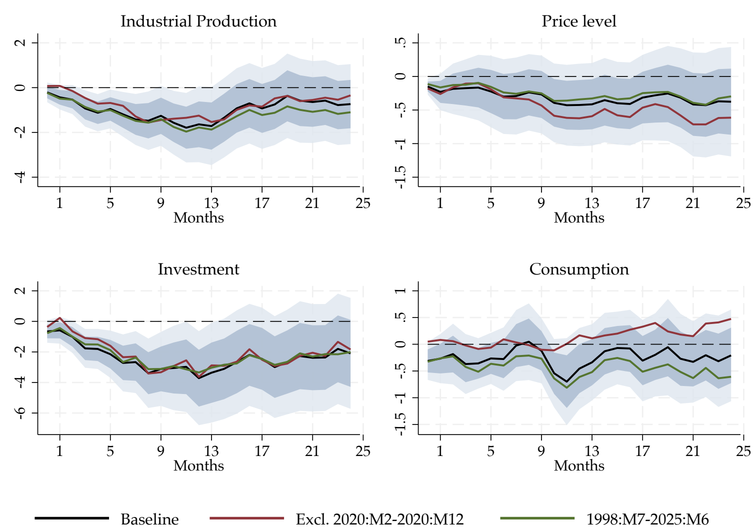


Figure C22: Different samples

Note: this figure replicates Figure 5, but on different samples.

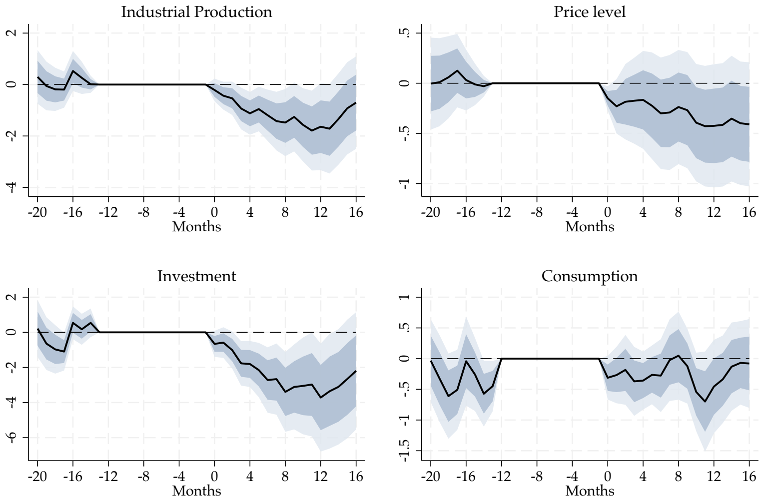


Figure C23: Checking for pre-trends

Note: this figure check for the presence of pre-trends in variables analyzed in Figure 5.

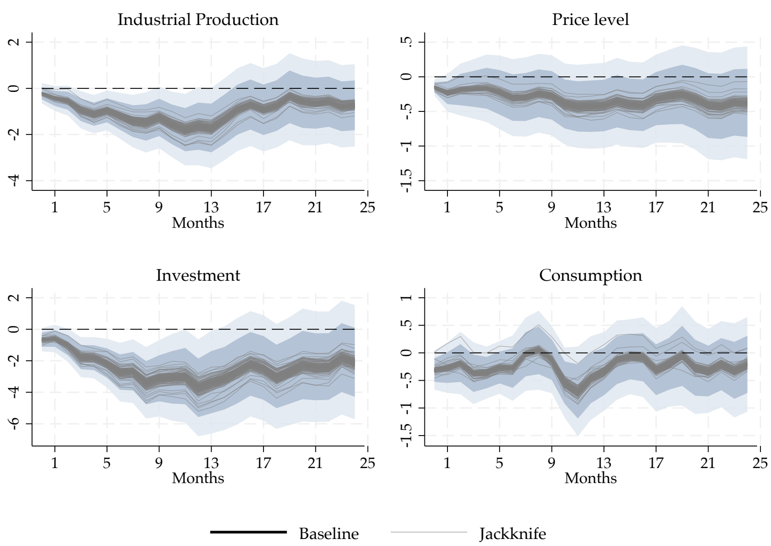


Figure C24: Jackknife exercise

Note: this figure studies the sensitivity of the results of Figure 5 to influential observations in our shock series. The gray lines are responses obtained from the jackknife, censoring one shock value at a time. The confidence bands and point estimate are instead from our baseline specification (Figure 5).

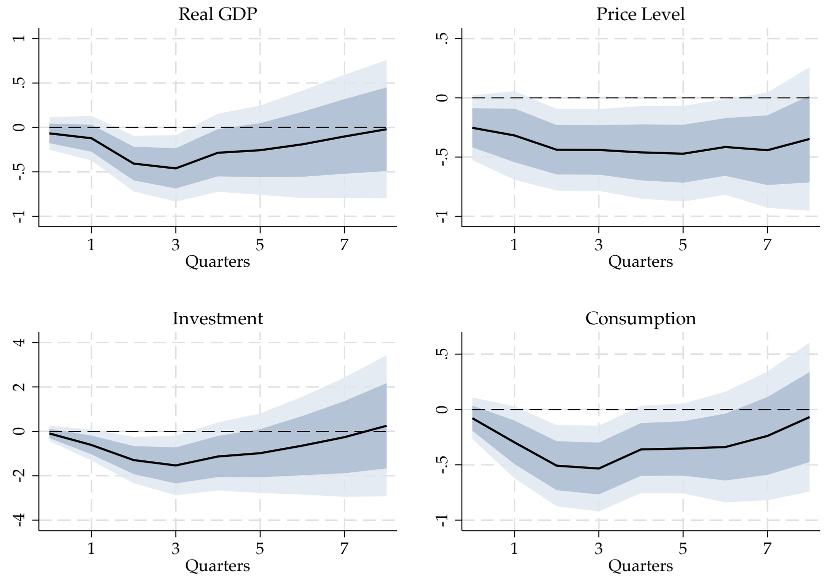


Figure C25: Quarterly results on macroeconomic variables

Note: this figure replicates the results of Figure 5 but at a quarterly frequency. We aggregate the shock from daily to quarterly frequency following Gertler and Karadi (2015). The x-axis shows months from the shock, while the y-axis shows the response in percentage changes. The dark line represents the point estimate, while light and dark gray shaded areas represent 68% and 90% heteroskedasticity-robust confidence intervals.

Confidence intervals. In our baseline analysis, we followed Montiel Olea and Plagborg-Møller (2021) and estimated a "lag-augmented" local projection, with heteroskedasticity-robust standard errors. Here, we show that this choice is immaterial for our findings. Figure C26 replicates results of Figure 5 by using Newey-West confidence intervals.

Another concern one may have is that our shock series is first obtained by running a principal component analysis on the four high-frequency Treasury futures surprises. In a second step, this series is used as a shock in our local projection. Our confidence intervals do not take into account the uncertainty regarding the first step. As a robustness exercise, Figure C27 shows results are nearly identical when using the high-frequency change in the 10-year future, which automatically sidesteps the issue.

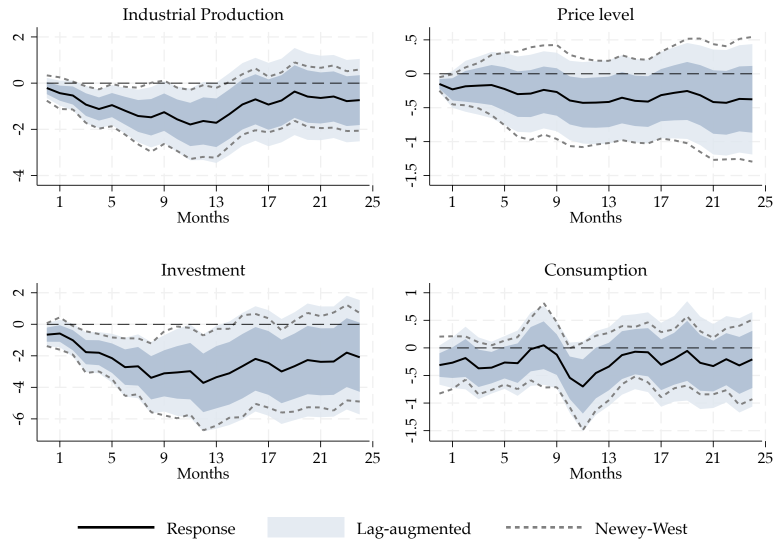


Figure C26: Different confidence intervals

Note: this figure replicates results Figure 5 with two different confidence intervals: heteroskedasticity-robust (lag-augmented) and Newey-West.

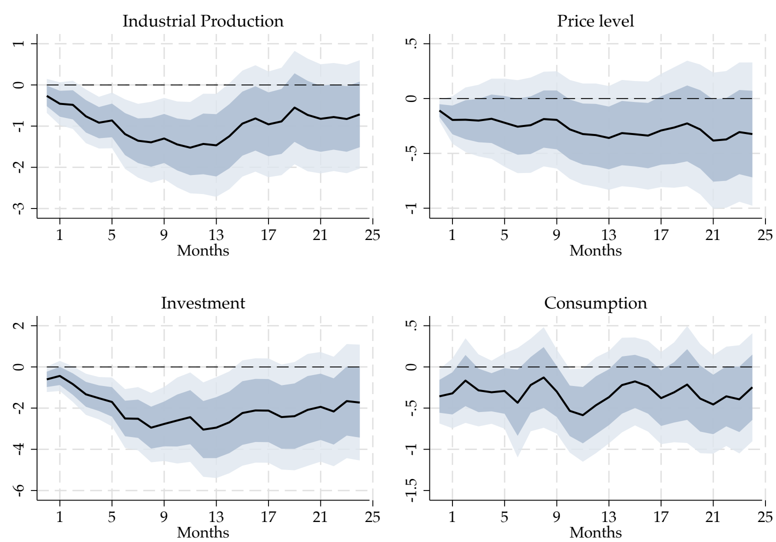


Figure C27: Responses to the 10-year Treasury future high-frequency surprise

Note: this figure replicates the results of Figure 5, but uses as the shock measure the high-frequency change in the 10-year Treasury future.

Shock: window, aggregation, and other definitions. In this section, we show that our result is robust to different ways of constructing the shock. First, we change the high-frequency window around the announcement (Figure C28).[25] Second, we change aggregation method and simply sum the daily surprises within a month (Figure C29). Third, we orthogonalize the shock with respect to news available prior to the announcements (Figure C30). Fourth, we clean the shock from information effects following the Poor Man's approach of Jarociński and Karadi (2020) (Figure C31).

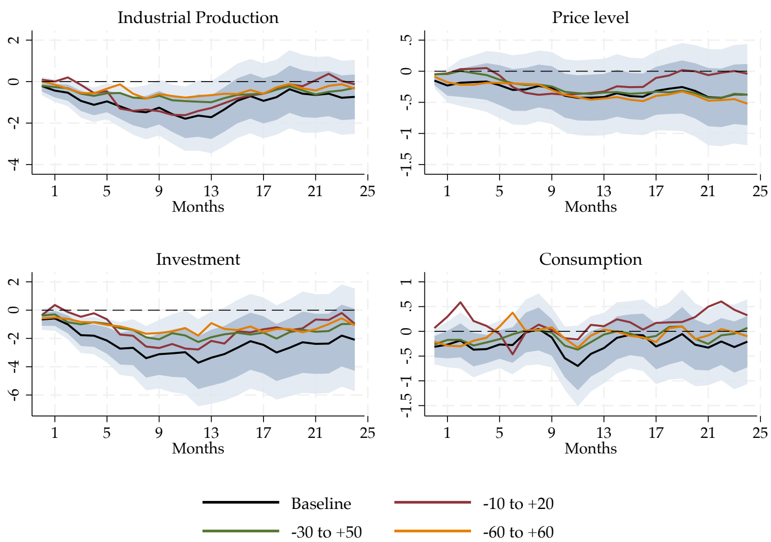


Figure C28: Different windows around auction announcements

Note: this figure checks the sensitivity of the result presented in Figure 5 to the use of different time windows around auction announcements. The lines correspond to point estimates.

[25]The choice of the window does not alter the qualitative results, but sometimes it affects the magnitude of the responses.

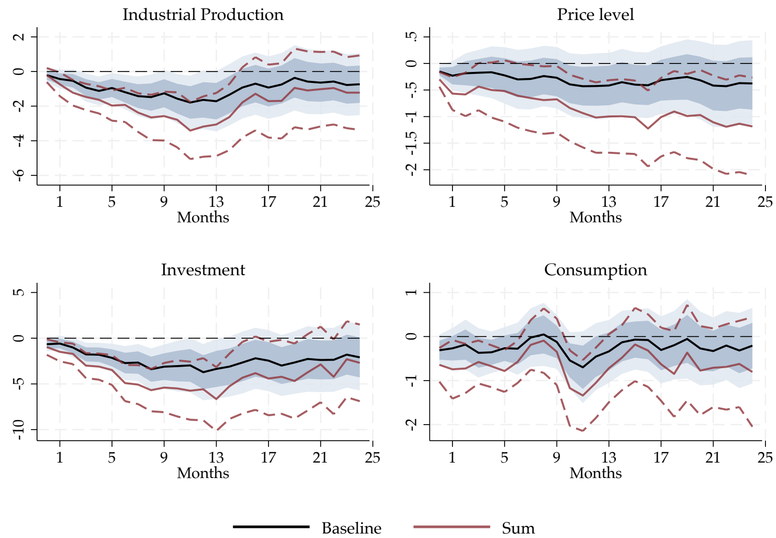


Figure C29: Different aggregation methods

Note: this figure checks the sensitivity of the result presented in Figure 5 to different temporal aggregation methods. The solid lines correspond to point estimates, while the dashed lines to the 68% confidence bands.

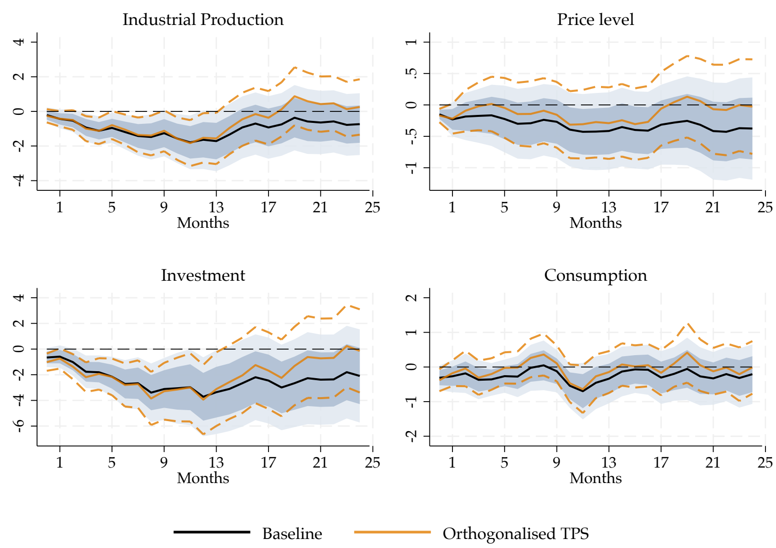


Figure C30: Orthogonalizing the shock with respect to news

Note: this figure checks the sensitivity of the result presented in Figure 5 with respect to the use of orthogonalized Treasury policy shocks defined as the residual from column (1) of Table A4. The solid orange lines are the point estimates and the orange dashed lines are 68% confidence bands.

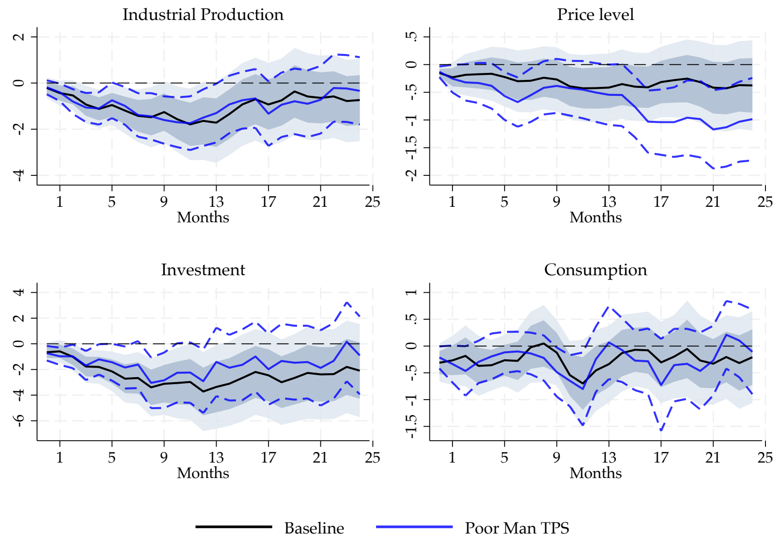


Figure C31: Poor Man's approach

Note: this figure checks the sensitivity of the result presented in Figure 5 with respect to the adoption of Poor Man's approach of Jarociński and Karadi (2020). We set to zero observations with a strictly positive correlation between the high-frequency change in the first principal component and the S&P 500 futures price. The solid blue lines are the point estimates and the blue dashed lines are 68% confidence bands.

Different estimation strategy. As an alternative estimation method, we estimate a VAR using the internal instrument approach (Plagborg-Møller and Wolf, 2021). Mirroring the baseline local-projection specification, we estimate a recursive VAR with twelve lags that includes the monthly Treasury policy shock, the five-year Treasury yield, industrial production, the price level, and the excess bond premium, ordering the Treasury policy shock first. Impulse responses of industrial production and the price level are obtained directly from this system. To study the responses of investment and consumption, we augment the baseline VAR by adding each variable in turn and compute its impulse response. Results in Figure C32 show that results are not particularly sensitive to the estimation strategy.

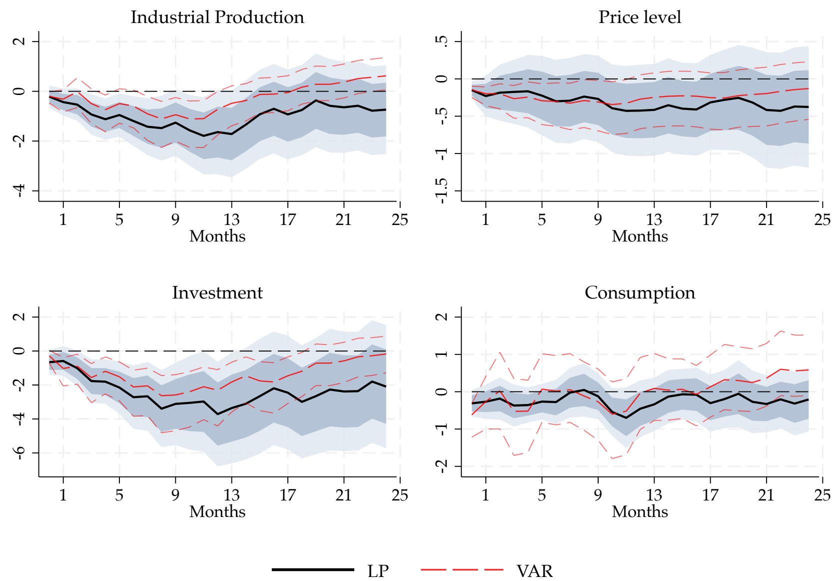


Figure C32: Results using internal VAR

Note: this figure examines the sensitivity of the result presented in Figure 5 to the use of VAR instead of local projection. The black solid line and the gray confidence bands correspond to the response of variables to a Treasury policy shock using local projections. The red dashed lines correspond to the point estimate and 68% from the VAR.

D. Treasury and monetary policy shocks: an equivalence

In this Appendix, we provide additional evidence on the similarity between the effects of Treasury and monetary policy shocks. First, we present additional local projection results and a range of robustness checks. Second, we describe the full DSGE model, explain its empirical implementation, and report several robustness exercises.

D.1. Additional Evidence from Local Projections

Figure D1 shows that both the Treasury and the monetary policy shock lead to a tightening of financial conditions, as seen by the rise of the Financial Conditions Index. In particular, credit conditions worsen, as shown by the increase in the excess bond premium and by the Baa-Aaa spread.

This tightening of financial conditions is behind the effects presented in Figure 7. Figure D2 extends this insight, showing that the similarity holds also when looking at the response of the unemployment rate and of durable consumption.

Finally, we explore this equivalence with a different measure of monetary policy shock. In particular, we follow Cloyne et al. (2023) and estimate a proxy structural VAR that uses the orthogonalized monetary policy surprise from Bauer and Swanson, 2023 as an external instrument for the monetary policy shock. The reduced-form VAR includes industrial production, CPI, the excess bond premium, and the two-year Treasury rate, and is estimated over the period 1977:M6 to 2020:M2. The monetary policy surprise is available from 1988:M1 onward and is used to instrument the residual of the two-year Treasury rate equation. Endowed with this shock measure, we explore the similarity between the two shocks in Figure D3. Results are very similar, and the responses are more precise. Only the response of consumption gets attenuated and becomes less persistent.

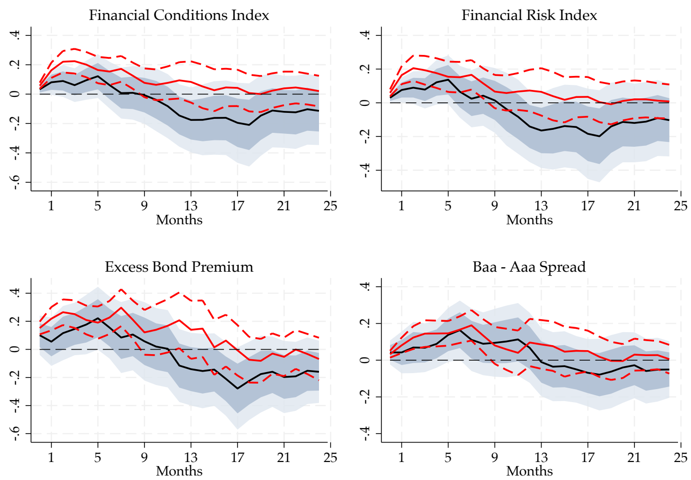


Figure D1: Financial responses to Treasury and monetary policy shocks

Note: the black solid line and the gray confidence bands correspond to the response of financial variables to a Treasury policy shock. The red solid line and the dashed lines correspond to the point estimate and 68% confidence bands of the response to a monetary policy shock. The monetary policy shock is the orthogonalized surprise from Bauer and Swanson (2023). The x-axis shows months from when the shock hits, while the y-axis the percentage points. The estimation sample is 1988:M1 - 2020:M2 for the monetary policy shock; 2003:M7 - 2025:M2 for the Treasury policy shock.

Figure D2: Other macroeconomic responses to Treasury and monetary policy shocks

Note: the black solid line and the gray confidence bands correspond to the response of credit variables to a Treasury policy shock. The red solid line and the dashed lines correspond to the point estimate and 68% confidence bands of the response to a monetary policy shock. The monetary policy shock is the orthogonalized surprise from Bauer and Swanson (2023). The x-axis shows months from when the shock hits, while the y-axis the percentage points (changes) for the left (right) graph. The estimation sample is 1988:M1 - 2020:M2 for the monetary policy shock; 2003:M7 - 2025:M2 for the Treasury policy shock.

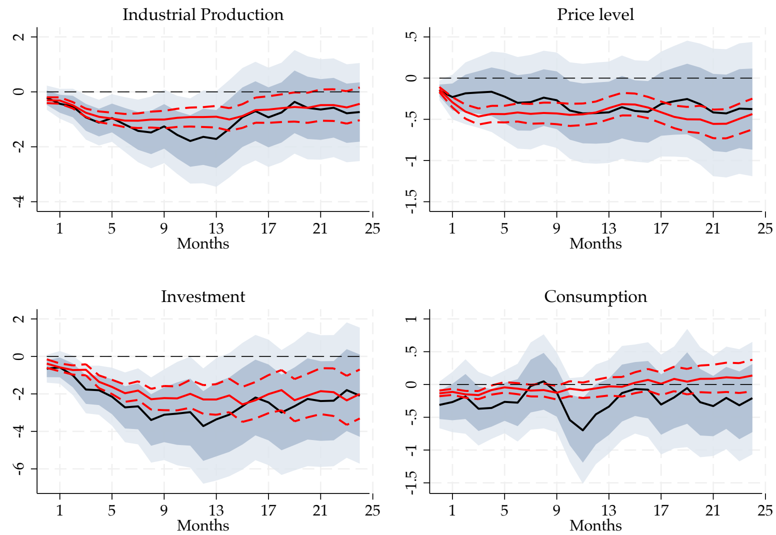


Figure D3: Monetary policy shock extracted from VAR

Note: the black solid line and the gray confidence bands correspond to the response of real variables to a Treasury policy shock. The red solid line and the dashed lines correspond to the point estimate and 68% confidence bands of the response to a monetary policy shock. The structural shock is obtained from a proxy SVAR where we use as instrument the monetary policy surprise from Bauer and Swanson (2023). We follow the methodology suggested by Cloyne et al. (2023) to retrieve the structural shock. The x-axis shows months from when the shock hits, while the y-axis the percentage changes. The estimation sample is 1988:M1 - 2020:M2 for the monetary policy shock; 2003:M7 - 2025:M2 for the Treasury policy shock.

D.2. DSGE model with financial block

We augment the DSGE model of Christiano, Eichenbaum, and Evans (2005) and Smets and Wouters (2007) with a financial block featuring different types of investors and three Treasury bonds. We first describe every block of the model and the log-linearized equilibrium conditions. We then provide details on how we do IRF-matching and how we calibrate all the model parameters. Finally, we show the main results together with some robustness exercises.

D.2.1. Model Description

Final goods producers. The final good Y_t is a composite of a continuum of intermediate goods $Y_t(i)$ as in Kimball (1995). Final goods producers buy intermediate goods, package Y_t, and resell it to consumers, investors, and the government in a perfectly competitive market. Their problem is:

$$\max_{Y_t, Y_t(i)} \; P_t Y_t - \int_0^1 P_t(i)\, Y_t(i)\, di \tag{12}$$

$$\text{s.t.} \quad \int_0^1 G\!\left(\frac{Y_t(i)}{Y_t}\right) di = 1 \tag{13}$$

where P_t and $P_t(i)$ are the prices of the final and intermediate goods, G is a strictly concave and increasing function with $G(1) = 1$. The first-order conditions are

$$(\partial Y_t): \quad P_t = \frac{\mu_{f,t}}{Y_t} \int_0^1 G'\!\left(\frac{Y_t(i)}{Y_t}\right) \frac{Y_t(i)}{Y_t}\, di \tag{14}$$

$$(\partial Y_t(i)): \quad P_t(i) = \mu_{f,t}\, G'\!\left(\frac{Y_t(i)}{Y_t}\right) \left[\int_0^1 G'\!\left(\frac{Y_t(i)}{Y_t}\right) \frac{Y_t(i)}{Y_t}\, di\right]^{-1} \tag{15}$$

where $\mu_{f,t}$ is the Lagrange multiplier on the resource constraint. This yields the demand for each intermediate variety:

$$Y_t(i) = Y_t\, G'^{-1}\!\left(\frac{P_t(i)}{P_t} \int_0^1 G'\!\left(\frac{Y_t(i)}{Y_t}\right) \frac{Y_t(i)}{Y_t}\, di\right). \tag{16}$$

Intermediate goods producers. Intermediate goods producer i uses the following technology:

$$Y_t(i) = \; K_t^s(i)^\alpha \left(\gamma_t L_t(i)\right)^{1-\alpha} - \gamma^t \Phi \tag{17}$$

where $K_t^s(i)$ is capital services, $L_t(i)$ aggregate labour, Φ a fixed cost, and γ^t is the labour-augmenting deterministic growth factor. The firm's profit is

$$P_t(i) Y_t(i) - W_t L_t(i) - R_t^k K_t(i), \tag{18}$$

where W_t is the aggregate nominal wage and R_t^k the rental rate on capital. Cost minimisation yields:

$$(\partial L_t(i)): \quad \Theta_t(i)\, \gamma_t (1-\alpha)\, K_t^s(i)^\alpha\, L_t(i)^{-\alpha} = W_t \tag{19}$$

$$(\partial K_t^s(i)): \quad \Theta_t(i)\, \gamma_t\, \alpha\, K_t^s(i)^{\alpha-1}\, L_t(i)^{1-\alpha} = R_t^k \tag{20}$$

where $\Theta_t(i)$ is the Lagrange multiplier on the production constraint, equal to marginal cost MC_t. Combining equations (19)–(20) and noting that the capital–labour ratio is identical across firms:

$$\frac{K_t^s}{L_t} = \frac{\alpha}{1-\alpha} \frac{W_t}{R_t^k}. \tag{21}$$

Marginal cost is the same for all firms and equals:

$$MC_t = \alpha^{-\alpha} (1-\alpha)^{-(1-\alpha)}\, W_t^{1-\alpha}\, (R_t^k)^\alpha\, \gamma_t^{-(1-\alpha)}. \tag{22}$$

Under Calvo pricing with partial indexation, the firm permitted to re-optimise in period t (with probability $1-\xi_p$) solves:

$$\max_{\tilde{P}_t(i)} E_t \sum_{s=0}^{\infty} (\xi_p \beta)^s \frac{\Xi_{t+s} P_t}{\Xi_t P_{t+s}} \left[\tilde{P}_t(i) \prod_{l=1}^{s} \pi_{t+l-1}^{\iota_p} \pi_*^{1-\iota_p} - MC_{t+s} \right] Y_{t+s}(i) \tag{23}$$

$$\text{s.t. } Y_{t+s}(i) = Y_{t+s} G'^{-1}\big(\tilde{P}_t(i) X_{t,s} / P_{t+s} \cdot \tau_{t+s}\big), \tag{24}$$

where $\tau_{t+s} = \int_0^1 G'(Y_{t+s}(i)/Y_{t+s})(Y_{t+s}(i)/Y_{t+s})\, di$ and the cumulative indexation factor is

$$X_{t,s} = \begin{cases} 1 & s = 0 \\ \prod_{l=1}^{s} \pi_{t+l-1}^{\iota_p} \pi_*^{1-\iota_p} & s = 1, 2, \ldots \end{cases} \tag{25}$$

Firms that cannot re-optimise index their price as $P_t(i) = \pi_{t-1}^{\iota_p} \pi_*^{1-\iota_p} P_{t-1}(i)$. The first-order condition is:

$$E_t \sum_{s=0}^{\infty} (\xi_p \beta)^s \frac{\Xi_{t+s} P_t}{\Xi_t P_{t+s}} Y_{t+s}(i)\, X_{t,s} \left[\tilde{P}_t(i) + \big(\tilde{P}_t(i) X_{t,s} - MC_{t+s}\big) \frac{G''(x_{t+s})}{G'^{-1}(z_{t+s}) G''(x_{t+s})} \right] = 0 \tag{26}$$

where $x_{t+s} = G'^{-1}(z_{t+s})$ and $z_{t+s} = \tilde{P}_t(i) X_{t,s} / P_{t+s} \cdot \tau_{t+s}$.
The aggregate price index satisfies:

$$P_t = \left[(1-\xi_p)\, \tilde{P}_t(i)\, G'^{-1}\left(\frac{\tilde{P}_t(i) \tau_t}{P_t} \right) + \xi_p \pi_{t-1}^{\iota_p} \pi_*^{1-\iota_p} P_{t-1}\, G'^{-1}\left(\frac{\pi_{t-1}^{\iota_p} \pi_*^{1-\iota_p} P_{t-1} \tau_t}{P_t} \right) \right]^{-1}. \tag{27}$$

Households. Household j chooses consumption $C_t(j)$, hours worked $L_t(j)$, bonds $B_t(j)$, investment $I_t(j)$, and capital utilisation $Z_t(j)$ to maximise:

$$E_t \sum_{s=0}^{\infty} \beta^s \frac{1}{1-\sigma_c} (C_{t+s}(j) - \lambda C_{t+s-1})^{1-\sigma_c} \exp\left(\frac{\sigma_c - 1}{1+\sigma_l} L_{t+s}(j)^{1+\sigma_l} \right) \tag{28}$$

subject to the budget constraint:

$$\begin{aligned} & C_{t+s}(j) + I_{t+s}(j) + \frac{D_{t+s+1}(j)}{P_{t+s}} - T_{t+s} - \frac{Div_{t+s}}{P_{t+s}} \\ = & \frac{B_{t+s-1}(j)}{P_{t+s}} + \frac{W_{t+s}^h(j) L_{t+s}(j)}{P_{t+s}} + \frac{R_{t+s}^k Z_{t+s}(j) K_{t+s-1}(j)}{P_{t+s}} - a(Z_{t+s}(j)) K_{t+s-1}(j) + \frac{D_{t+s}(j)}{P_{t+s}} R_{t+s} \end{aligned} \tag{29}$$

and the capital accumulation equation:

$$K_t(j) = (1-\delta)\, K_{t-1}(j) + \left[1 - S\left(\frac{I_t(j)}{I_{t-1}(j)} \right) \right] I_t(j). \tag{30}$$

There is external habit formation captured by λ. The depreciation rate is δ. $S(\cdot)$ is the investment adjustment cost with $S(\gamma) = 0$, $S'(\gamma) = 0$, $S''(\gamma) > 0$. T_{t+s} are lump-sum taxes and Div_t nominal dividends from the labour unions.

Households place their deposit $D_t(j)$ at a deposit institution which earns an ex-post period return of R_{t+1}. Households also choose the utilisation rate $Z_t(j)$ of capital. the effective capital services rented to firms are $K_t^s(j) = Z_t(j)K_{t-1}(j)$ charged at $P_t a(Z_t(j))K_{t-1}(j)$.

In equilibrium all households make identical choices (dropping the j index). The first-order conditions are:

$$(\partial C_t): \quad \Xi_t = \exp\left(\frac{\sigma_c - 1}{1+\sigma_l} L_t^{1+\sigma_l}\right)(C_t - \lambda C_{t-1})^{-\sigma_c} \tag{31}$$

$$(\partial L_t): \quad \frac{W_t^h}{P_t}\Xi_t = (C_t - \lambda C_{t-1})^{1-\sigma_c} \exp\left(\frac{\sigma_c - 1}{1+\sigma_l} L_t^{1+\sigma_l}\right) L_t^{\sigma_l} \tag{32}$$

$$(\partial D_{t+1}): \quad \Xi_t = \beta\, E_t\left[R_{t+1}\frac{\Xi_{t+1}}{\pi_{t+1}}\right] \tag{33}$$

$$(\partial I_t): \quad \Xi_t = \Xi_t^k\left[1 - S\left(\frac{I_t}{I_{t-1}}\right) - S'\left(\frac{I_t}{I_{t-1}}\right)\frac{I_t}{I_{t-1}}\right] + \beta E_t\left[\Xi_{t+1}^k S'\left(\frac{I_{t+1}}{I_t}\right)\left(\frac{I_{t+1}}{I_t}\right)^2\right] \tag{34}$$

$$(\partial \bar{K}_t): \quad \Xi_t^k = \beta E_t\left[\Xi_{t+1}\left(\frac{R_{t+1}^k Z_{t+1}}{P_{t+1}} - a(Z_{t+1})\right) + \Xi_{t+1}^k(1-\delta)\right] \tag{35}$$

$$(\partial Z_t): \quad \frac{R_t^k}{P_t} = a'(Z_t) \tag{36}$$

where Ξ_t and Ξ_t^k are the Lagrange multipliers on the budget constraint and capital accumulation equation respectively. Tobin's q is defined as $Q_t = \Xi_t^k/\Xi_t$, which equals one in the absence of adjustment costs.

Financial sector. A representative deposit institution accepts deposits D_t from households and allocates them across three investor types: preferred habitat investors, arbitrageurs, and reach-for-yield investors. Quasi-linearity of preferences implies that the split between arbitrageurs and reach-for-yield investors is irrelevant for equilibrium, so we assume without loss of generality that all funds go to the arbitrageur.

Investors allocate funds across short-, medium-, and long-term bonds. Following Woodford (2001), the medium- and long-term bonds are geometrically decaying: a unit of bond $j \in \{m, l\}$ outstanding in period t pays ρ_j^{k-1} nominal units in period $t+k$, with $\rho_s = 0$ recovering the short-term bond. The yield-to-maturity $\mathcal{R}_t^j$ is implicitly defined by

$$Q_t^j = \sum_{k=1}^{\infty} \frac{\rho_j^{k-1}}{(\mathcal{R}_t^j)^k}, \tag{37}$$

the discount rate that rationalises the bond price Q_t^j. The FOCs and log-linearised solution are provided below.

Preferred habitat investors. These investors require steady-state levels of the three bonds inelastically in real terms. The role of this class of investors is to eliminate the steady-state risk premia on medium- and long-term bonds, ensuring that the steady-state yields on all three bond types are equal to the natural rate $r^*\pi^*$.

$$\frac{1}{P_t\gamma^t}\begin{bmatrix} B^s_{t,p} \\ B^m_{t,p} \\ B^l_{t,p} \end{bmatrix} = \begin{bmatrix} b^{*,s} \\ b^{*,m} \\ b^{*,l} \end{bmatrix} \tag{38}$$

This assumption also implies that the shocks to debt supply need to be fully absorbed by the arbitrageur and the reach-for-yield investor.

Arbitrageurs. The arbitrageur's profit is given by:

$$\Pi^a_{t+1} = \underbrace{\sum_{j\in\{s,m,l\}} (1-Q^j_t)\frac{B^j_{t,a}}{P_t\gamma^t}}_{\text{coupon gain}} + \underbrace{\sum_{j\in\{m,l\}} \rho_j Q^j_{t+1}\frac{B^j_{t,a}}{P_t\gamma^t}}_{\text{capital gain}} \tag{39}$$

Arbitrageurs have mean-variance preferences over the profit stream:

$$\max_{\{B^j_{t,a}\}_{j\in\{s,m,l\}}} \quad \mathbb{E}_t\Pi^a_{t+1} - \frac{\psi^a}{2}\mathbb{V}_t\Pi^a_{t+1} \tag{40}$$

$$\text{st} \quad \sum_{j\in\{s,m,l\}} Q^j_t\frac{B^j_{t,a}}{P_t\gamma^t} = \frac{D_t}{P_t\gamma^t} - \sum_{j\in\{s,m,l\}} Q^j_t\frac{B^j_{t,p}}{P_t\gamma^t} \tag{41}$$

Let $b^j_{t,a} = \frac{B^j_{t,a}}{P_t\gamma^t}$ denote the detrended real amount invested in bond type j by an arbitrageur. Under stationarity, the objective function can be rewritten as:

$$\begin{bmatrix} 1-Q^s_t & 1-Q^m_t+\rho_m\mathbb{E}_tQ^m_{t+1} & 1-Q^l_t+\rho_l\mathbb{E}_tQ^l_{t+1} \end{bmatrix}\begin{bmatrix} b^s_{t,a} \\ b^m_{t,a} \\ b^l_{t,a} \end{bmatrix} - \frac{\psi^a}{2}\begin{bmatrix} b^m_{t,a} & b^l_{t,a} \end{bmatrix}\tilde{\Sigma}\begin{bmatrix} b^m_{t,a} \\ b^l_{t,a} \end{bmatrix} \tag{42}$$

where $\tilde{\Sigma} = \mathbb{V}_t \left[\rho_m Q^m_{t+1} \quad \rho_l Q^l_{t+1} \right]$. The FOCs with respect to $b^s_{t,a}$, $b^m_{t,a}$, and $b^l_{t,a}$ imply:

$$\begin{bmatrix} 1 - Q^m_t + \rho_m \mathbb{E}_t Q^m_{t+1} \\ 1 - Q^l_t + \rho_l \mathbb{E}_t Q^l_{t+1} \end{bmatrix} - \psi^a \tilde{\Sigma} \begin{bmatrix} b^m_{t,a} \\ b^l_{t,a} \end{bmatrix} = \begin{bmatrix} Q^m_t (R^s_t - 1) \\ Q^l_t (R^s_t - 1) \end{bmatrix} \tag{43}$$

$$\psi^a \tilde{\Sigma} \begin{bmatrix} b^m_{t,a} \\ b^l_{t,a} \end{bmatrix} = \begin{bmatrix} Q^m_t (\mathbb{E}_t R^m_{t+1} - R^s_t) \\ Q^l_t (\mathbb{E}_t R^l_{t+1} - R^s_t) \end{bmatrix} \tag{44}$$

where $R^j_{t+1} = (1 + \rho_j Q^j_{t+1}) / Q^j_t$ is the ex-post one-period return on bond type j from period t to $t+1$.

Reach-for-yield investors. Reach-for-yield investors only care about the spread between the yield-to-maturity and the short-term yield subject to mean-variance preferences. Their perceived profit is given by:

$$\Pi^r_{t+1} = \sum_{j \in \{s,m,l\}} \left(\mathcal{R}^j_t - 1 \right) Q^j_t \frac{B^j_{t,r}}{P_t \gamma^t} \tag{45}$$

Reach-for-yield investors have mean-variance preferences over the profit stream and the capital gains:

$$\max_{\{B^j_{t,r}\}_{j \in \{s,m,l\}}} \quad \Pi^r_{t+1} - \frac{\psi^r}{2} \mathbb{V}_t \underbrace{\sum_{j \in \{m,l\}} \rho_j Q^j_{t+1} \frac{B^j_{t,r}}{P_t \gamma^t}}_{\text{capital gain}} \tag{46}$$

$$\text{st} \quad \sum_{j \in \{s,m,l\}} \frac{B^j_{t,r}}{P_t \gamma^t} = 0 \tag{47}$$

Similarly to the arbitrageur, the FOCs imply:

$$\psi^r \tilde{\Sigma} \begin{bmatrix} b^m_{t,r} \\ b^l_{t,r} \end{bmatrix} = \begin{bmatrix} Q^m_t (\mathcal{R}^m_t - R^s_t) \\ Q^l_t (\mathcal{R}^l_t - R^s_t) \end{bmatrix} \tag{48}$$

Aggregating across investors. The ex-post return on the deposit is given by:

$$R_{t+1} = \frac{\sum_{j \in \{s,m,l\}} (1 + \rho_j Q^j_{t+1}) B^j_t}{\sum_{j \in \{s,m,l\}} Q^j_t B^j_t} \tag{49}$$

Since all bonds give the same rate of return at the steady state, log-linearisation around the steady state yields:

$$\hat{R}_{t+1} = \sum_{j\in\{s,m,l\}} \underbrace{\frac{Q_*^j b_*^j}{\sum_{k\in\{s,m,l\}} Q_* b_*^k}}_{\text{market share of bond type } j} \quad \hat{R}_{t+1}^j. \tag{50}$$

Moreover, aggregating across demand functions (38),(44), and (48),

$$\begin{bmatrix} b_t^m \\ b_t^l \end{bmatrix} = \begin{bmatrix} b_*^m \\ b_*^l \end{bmatrix} + \tilde{\Sigma}^{-1}\left(\frac{1}{\psi^a} \begin{bmatrix} Q_t^m(\mathbb{E}_t R_{t+1}^m - R_t^s) \\ Q_t^l(\mathbb{E}_t R_{t+1}^l - R_t^s) \end{bmatrix} + \frac{1}{\psi^r} \begin{bmatrix} Q_t^m(\mathcal{R}_t^m - R_t^s) \\ Q_t^l(\mathcal{R}_t^l - R_t^s) \end{bmatrix} \right) \tag{51}$$

Log-linearisation around the steady state gives:

$$\begin{bmatrix} b_*^m \hat{b}_t^m \\ b_*^l \hat{b}_t^l \end{bmatrix} = \Sigma \left(\frac{1}{\psi^a} \begin{bmatrix} Q_*^m(\mathbb{E}_t \hat{R}_{t+1}^m - \hat{R}_t^s) \\ Q_*^l(\mathbb{E}_t \hat{R}_{t+1}^l - \hat{R}_t^s) \end{bmatrix} + \frac{1}{\psi^r} \begin{bmatrix} Q_*^m(\hat{\mathcal{R}}_t^m - \hat{R}_t^s) \\ Q_*^l(\hat{\mathcal{R}}_t^l - \hat{R}_t^s) \end{bmatrix} \right) \tag{52}$$

where $\Sigma = \tilde{\Sigma}^{-1} R_*$.

Intermediate labor union sector. Labor used by intermediate goods producers is a composite:

$$L_t = \left[\int_0^1 L_t(l)^{\frac{1}{1+\lambda_w}} \, dl \right]^{1+\lambda_w} \tag{53}$$

Labour packers buy labour from unions, package L_t, and resell it to intermediate goods producers in a perfectly competitive environment. From the packers' first-order conditions:

$$L_t(l) = \left(\frac{W_t(l)}{W_t} \right)^{-(1+\lambda_w)/\lambda_w} L_t \tag{54}$$

and the zero-profit (aggregate wage) condition:

$$W_t = \left[\int_0^1 W_t(l)^{1/\lambda_w} \, dl \right]^{\lambda_w}. \tag{55}$$

Unions differentiate labour services and set wages subject to Calvo frictions. The household's labour supply condition equates the real shadow wage to the marginal rate of substitution:

$$\frac{W_t^h}{P_t} = (C_t - \lambda C_{t-1})^{-\sigma_c} \exp\left(\frac{\sigma_c - 1}{1+\sigma_l} L_t^{1+\sigma_l} \right) \frac{(\sigma_c - 1) L_t^{\sigma_l}}{1 - \sigma_c} \frac{1}{\Xi_t}. \tag{56}$$

With probability $1 - \xi_w$ the union can adjust its wage; otherwise it indexes as $W_t(l) = \gamma \pi_{t-1}^{\iota_w} \pi_*^{1-\iota_w} W_{t-1}(l)$.

The re-optimising union chooses $\tilde{W}_t(l)$ to maximise:

$$\max_{\tilde{W}_t(l)} E_t \sum_{s=0}^{\infty} (\xi_w \beta)^s \frac{\Xi_{t+s} P_t}{\Xi_t P_{t+s}} \left[\tilde{W}_t(l) - W^h_{t+s} \right] L_{t+s}(l) \tag{57}$$

with $\tilde{L}_{t+s}(l) = \left(\tilde{W}_t(l) X^w_{t,s} / W_{t+s} \right)^{-(1+\lambda_w)/\lambda_w} L_{t+s}$, where $X^w_{t,s} = \prod_{l=1}^{s} \gamma \pi^{\iota_w}_{t+l-1} \pi_*^{1-\iota_w}$ for $s \geq 1$ and 1 for $s = 0$ is the automatic wage adjustment factor. The first-order condition is:

$$E_t \sum_{s=0}^{\infty} (\xi_w \beta)^s \frac{\Xi_{t+s} P_t}{\Xi_t P_{t+s}} L_{t+s}(l) \, \frac{1}{\lambda_w} \left[(1 + \Xi_{w,t+s}) W^h_{t+s} - X^w_{t,s} \, \tilde{W}_t(l) \right] = 0. \tag{58}$$

The aggregate wage evolves as:

$$W_t = \left[(1 - \xi_w) \tilde{W}_t^{1/\lambda_w} + \xi_w \left(\gamma \pi^{\iota_w}_{t-1} \pi_*^{1-\iota_w} W_{t-1} \right)^{1/\lambda_w} \right]^{\lambda_w}. \tag{59}$$

Central bank. The central bank follows a nominal interest rate rule, adjusting its instrument in response to deviations of inflation and output from their respective targets:

$$\frac{R^s_t}{R_*} = \left(\frac{R^s_{t-1}}{R_*} \right)^{\rho_R} \left[\left(\frac{\pi_t}{\pi_*} \right)^{\psi_1} \left(\frac{Y_t}{Y^*_t} \right)^{\psi_2} \right]^{1-\rho_R} \left(\frac{Y_t / Y_{t-1}}{Y^*_t / Y^*_{t-1}} \right)^{\psi_3} \tag{60}$$

where R_* is the steady-state nominal rate, Y^*_t is the natural (flexible-price) output, and ρ_R governs interest-rate smoothing.

Fiscal authority. The government budget constraint is:

$$P_t G_t + \sum_{j \in \{s,m,l\}} (1 + \rho_j Q^j_t) B^j_t = T_t + \sum_{j \in \{s,m,l\}} Q^j_t B^j_{t+1} \tag{61}$$

where T_t are nominal lump-sum taxes. Government spending $G_t / (\gamma^{*t} Y^*)$ is fixed at g^*.

Natural output level. The natural output level Y^*_t is defined as output in the flexible-price and flexible-wage economy, i.e. the equilibrium obtained when $\xi_p = \xi_w = 0$.

Resource constraint. Integrating the household budget constraint across households and combining with the government budget constraint and firm profits gives the goods market clearing condition:

$$C_t + I_t + G_t + a(Z_t) \bar{K}_{t-1} = Y_t \tag{62}$$

where Y_t is defined by equation (17). Price and wage dispersion terms appear at second order and are unity to a first-order approximation.

D.2.2. Log-linearized Equilibrium Conditions

Detrending. The model is detrended by the deterministic labour-augmenting growth rate γ, and nominal variables are replaced by their real counterparts. Lowercase letters denote detrended real variables. For instance, we have:

$$k_t = K_t/\gamma^t, \quad w_t = W_t/(P_t\gamma^t), \quad r_t^k = R_t^k/P_t. \tag{63}$$

Variables. Let $\hat{x}_t \equiv \ln x_t - \ln x_*$ denote the log-deviation of variable x_t from its steady-state value x_*, and let $\tilde{\beta} \equiv \beta/\gamma^{\sigma_c - 1}$. The log-linearized system determines the following 13 endogenous variables:

$$\begin{gathered}\hat{\pi}_t, \quad \hat{w}_t, \quad \hat{c}_t, \quad \hat{i}_t, \quad \hat{L}_t, \quad \hat{y}_t, \quad \hat{R}_t, \quad \widehat{mc}_t, \quad \hat{r}_t^k, \quad \hat{k}_t^s, \quad \hat{\bar{k}}_t, \quad \hat{Q}_t^k, \quad \hat{Z}_t, \\ \{\hat{Q}_t^j, \hat{R}_{t+1}^j, \hat{\mathcal{R}}_t^j\}_{j\in\{s,m,l\}}, \quad \hat{y}_t^*\end{gathered} \tag{64}$$

given three exogenous processes:[26]

$$\hat{b}_t^m, \quad \hat{b}_t^l, \quad \hat{r}_t \tag{65}$$

Equilibrium conditions.

Marginal cost.

$$\widehat{mc}_t = (1-\alpha)\hat{w}_t + \alpha\hat{r}_t^k. \tag{66}$$

New Keynesian Phillips curve.

$$\hat{\pi}_t = \frac{\iota_p}{1+\iota_p\tilde{\beta}}\hat{\pi}_{t-1} + \frac{\tilde{\beta}}{1+\iota_p\tilde{\beta}}E_t\hat{\pi}_{t+1} + \frac{(1-\xi_p\tilde{\beta})(1-\xi_p)}{\xi_p[(\phi_p-1)\varepsilon_p+1](1+\iota_p\tilde{\beta})}(\widehat{mc}_t). \tag{67}$$

Wage Phillips curve.

$$\begin{aligned}\hat{w}_t = {} & \frac{1}{1+\tilde{\beta}}\hat{w}_{t-1} + \frac{\tilde{\beta}}{1+\tilde{\beta}}(E_t\hat{w}_{t+1} + E_t\hat{\pi}_{t+1}) - \frac{1+\iota_w\tilde{\beta}}{1+\tilde{\beta}}\hat{\pi}_t + \frac{\iota_w}{1+\tilde{\beta}}\hat{\pi}_{t-1} \\ & - \frac{(1-\xi_w\tilde{\beta})(1-\xi_w)}{\xi_w(1+\tilde{\beta})}\left(\hat{w}_t - \sigma_l\hat{L}_t - \frac{\hat{c}_t - (\lambda/\gamma)\hat{c}_{t-1}}{1-\lambda/\gamma}\right).\end{aligned} \tag{68}$$

[26] In this exercise, we focus on the perfect foresight path under an exogenously set path of shocks. Hence, the exact stochastic properties of shocks are immaterial to our exercise.

Consumption Euler equation.

$$\hat{c}_t = \frac{\lambda/\gamma}{1+\lambda/\gamma}\hat{c}_{t-1} + \frac{1}{1+\lambda/\gamma}E_t\hat{c}_{t+1} + \frac{(\sigma_c - 1)w^{h*}L^*/c^*}{\sigma_c(1+\lambda/\gamma)}(\hat{L}_t - E_t\hat{L}_{t+1})$$
$$- \frac{1-\lambda/\gamma}{\sigma_c(1+\lambda/\gamma)}E_t\big(\hat{R}_{t+1} - \hat{\pi}_{t+1}\big). \tag{69}$$

Investment Euler equation.

$$\hat{i}_t = \frac{1}{1+\tilde{\beta}}\hat{i}_{t-1} + \frac{\tilde{\beta}}{1+\tilde{\beta}}E_t\hat{i}_{t+1} + \frac{1}{(1+\tilde{\beta})\gamma^2 S''}\hat{Q}^k_t. \tag{70}$$

Asset-pricing equation (Tobin's q).

$$\hat{Q}^k_t = -E_t\big(\hat{R}_{t+1} - \hat{\pi}_{t+1}\big) + \frac{r^k_*}{r^k_* + (1-\delta)}E_t\hat{r}^k_{t+1} + \frac{1-\delta}{r^k_* + (1-\delta)}E_t\hat{Q}^k_{t+1}. \tag{71}$$

Capital accumulation.

$$\hat{\bar{k}}_t = \left(1 - \frac{i_*}{\bar{k}_*}\right)\hat{\bar{k}}_{t-1} + \frac{i_*}{\bar{k}_*}\hat{i}_t \tag{72}$$

Capital services and utilisation.

$$\hat{k}^s_t = \hat{\bar{k}}_{t-1} + \hat{Z}_t \tag{73}$$
$$\hat{Z}_t = \underbrace{r^k_*/a''(1)}_{(1-\psi_z)/\psi_z}\hat{r}^k_t \tag{74}$$

Capital–labour ratio.

$$\hat{k}^s_t - \hat{L}_t = \hat{w}_t - \hat{r}^k_t. \tag{75}$$

Production function.

$$\hat{y}_t = \phi_p\Big(\alpha\hat{k}^s_t + (1-\alpha)\hat{L}_t\Big), \qquad \phi_p = \frac{y^* + \Phi}{y^*}. \tag{76}$$

Resource constraint.

$$\hat{y}_t = \frac{c^*}{y^*}\hat{c}_t + \frac{i^*}{y^*}\hat{i}_t + \frac{r^k_* k^*}{y^*}\hat{Z}_t. \tag{77}$$

Taylor rule.

$$\hat{R}^s_t = \rho_R\hat{R}^s_{t-1} + (1-\rho_R)[\psi_1\hat{\pi}_t + \psi_2(\hat{y}_t - \hat{y}^*_t)] + \psi_3[(\hat{y}_t - \hat{y}^*_t) - (\hat{y}_{t-1} - \hat{y}^*_{t-1})] + \hat{r}_t. \tag{78}$$

Bond pricing.

$$\begin{bmatrix} b_*^m \hat{b}_t^m \\ b_*^l \hat{b}_t^l \end{bmatrix} = \Sigma \left(\frac{1}{\psi^a} \begin{bmatrix} Q_*^m (\mathbb{E}_t \hat{R}_{t+1}^m - \hat{R}_t^s) \\ Q_*^l (\mathbb{E}_t \hat{R}_{t+1}^l - \hat{R}_t^s) \end{bmatrix} + \frac{1}{\psi^r} \begin{bmatrix} Q_*^m (\hat{\mathcal{R}}_t^m - \hat{R}_t^s) \\ Q_*^l (\hat{\mathcal{R}}_t^l - \hat{R}_t^s) \end{bmatrix} \right) \tag{79}$$

$$\hat{R}_{t+1} = \sum_{j \in \{s,m,l\}} \frac{Q_*^j b_*^j}{\sum_{k \in \{s,m,l\}} Q_* b_*^k} \hat{R}_{t+1}^j \tag{80}$$

as well as the bond pricing identities

$$\hat{R}_{t+1}^j = -\hat{Q}_t^j + \frac{\rho_j}{R_*} \hat{Q}_{t+1}^j \tag{81}$$

$$\hat{\mathcal{R}}_t^j = -Q_*^j R_*^j \left(1 - \frac{\rho_j}{R_*}\right)^2 \hat{Q}_t^j \quad \text{for } j \in \{s, m, l\} \tag{82}$$

Natural level of output. The natural level of output $\hat{y}_t$ is obtained by solving the above system with $\xi_p = \xi_w = 0$.

D.2.3. IRF-matching and calibration

In Tables D1 and D2, we show both the estimated parameters and the calibrated ones taken from the posterior mode or calibration of the Smets and Wouters (2007) estimation procedure.

We then construct the following empirical sequences:

$$\underbrace{\{\hat{b}_{t+1}^m, \hat{b}_{t+1}^l\}_{t=0}^{34}}_{\text{Treasury shock only}} \qquad \underbrace{\{\hat{R}_t^s\}_{t=0}^{7}}_{\text{both shocks}} . \tag{83}$$

Medium- and long-term bonds b_t^m and b_t^l are mapped to outstanding Treasury notes and bonds net of Federal Reserve holdings, deflated by the PCE price index. The short-term rate R_t^s is mapped to the policy rate, except for R_0^s, where we use the on-the-day response of the 3-month Treasury bill. Because medium- and long-term bonds are stock variables, we augment the local projection impulse responses with an exponential decay.

These sequences feed the two exercises differently. For the monetary policy shock, we feed in $\{\hat{r}_t\}_{t=0}^7$ to match the short-term rate path $\{\hat{R}_t^s\}_{t=0}^7$ alone. Figure D4 displays the path of $\hat{R}_t^s$ we match. For the Treasury policy shock, we additionally feed in $\{\hat{b}_{t+1}^m, \hat{b}_{t+1}^l\}_{t=0}^{34}$, jointly matching the bond paths and the policy rate. Figure D5 displays the empirical bond paths and the implied shock paths. We target the policy rate in the Treasury exercise to account for the Fed underreaction documented in Figure 9.

Figure D6 presents the results of the IRF-matching exercise based on the on-impact yield curve responses to both Treasury and monetary policy shocks. To assess the robustness of our findings (Figure 8) to the choice of targeted maturities, Figures D7 and D8 repeat the exercise using the average responses of short-, medium-, and long-term interest rates as matching targets. The results are largely unchanged: the model continues to match both the yield curve and the macroeconomic responses closely.

Table D1: Estimated Parameters

Symbol	Description	Value
Financial sector		
ψ^a	Arbitrageur risk aversion	0.0027
ψ^r	Reach-for-yield investor risk aversion	0.0257
Σ	Inverse of the variance-covariance matrix of bond returns	$\begin{bmatrix} 1 & -0.2338 \\ -0.2338 & 0.0555 \end{bmatrix}$
Preferences and households		
σ_c	Inverse elasticity of intertemporal substitution	0.8293
λ	Habit formation parameter	0.8326
Production and capital		
S''	Investment adjustment cost curvature	4.7244
Price and wage setting		
ξ_p	Calvo price stickiness (fraction not resetting)	0.6652

Table D2: Calibrated Parameters

Symbol	Description	Value	Source
Preferences and households			
β	Discount factor (quarterly)	0.9984	Estimated (SW2007)
σ_l	Inverse Frisch elasticity of labour supply	1.92	Estimated (SW2007)
γ	Quarterly trend growth rate	1.0043	Estimated (SW2007)
Production and capital			
α	Capital share in production	0.19	Estimated (SW2007)
δ	Capital depreciation rate (quarterly)	0.025	Calibrated (SW2007)
ϕ_p	Fixed cost factor ($\phi_p = (y^* + \Phi)/y^*$)	1.61	Estimated (SW2007)
ψ_z	Capital utilisation elasticity	0.54	Estimated (SW2007)
Price and wage setting			
ι_p	Price indexation to past inflation	0.22	Estimated (SW2007)
ε_p	Kimball goods aggregator curvature	10	Calibrated (SW2007)
ξ_w	Calvo wage stickiness (fraction not resetting)	0.73	Estimated (SW2007)
ι_w	Wage indexation to past inflation	0.59	Estimated (SW2007)
Monetary policy			
ρ_R	Interest rate smoothing	0.81	Estimated (SW2007)
ψ_1	Taylor rule: response to inflation	2.03	Estimated (SW2007)
ψ_2	Taylor rule: response to output gap	0.08	Estimated (SW2007)
ψ_3	Taylor rule: response to output gap growth	0.22	Estimated (SW2007)
Steady-state targets			
π^*	Steady-state inflation (% per quarter)	0.81	Estimated (SW2007)
Bonds			
ρ_m	Medium-term bond geometric decay rate	0.965	5-year duration (T-note)
ρ_l	Long-term bond geometric decay rate	0.903	10-year duration (T-bond)

Notes: All values are the posterior mode from the full-sample estimation in Smets and Wouters (2007) (Table 1) unless labelled "Calibrated." β is recovered from the reported $100(\beta^{-1} - 1) = 0.16$. γ is recovered from the quarterly trend growth rate $\bar{\gamma} = 0.43\%$.

D.2.4. Model results and robustness exercises

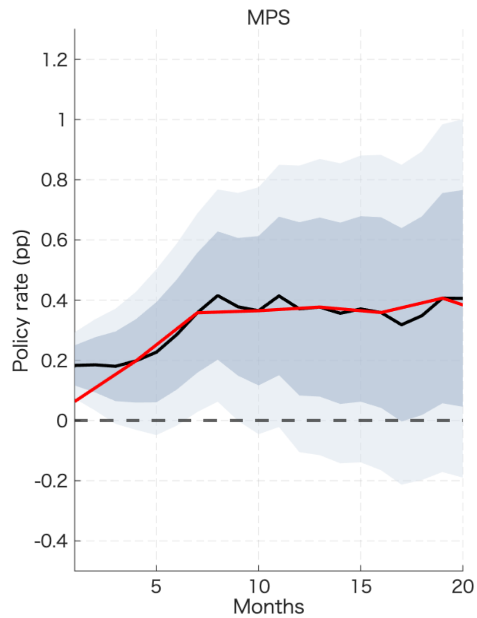


Figure D4: Path of the policy rate after MPS

Note: the black solid line shows the empirical path of the policy rate after a monetary policy shock. The red line shows the paths used as model inputs after a monetary policy shock.

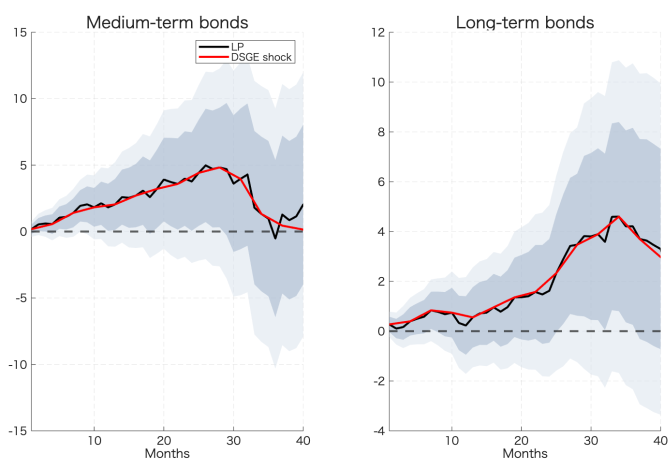


Figure D5: Paths of Treasury notes and bonds

Note: the black solid line shows the empirical paths of Treasury notes and bonds net of Fed holdings, deflated by the PCE price index, following Treasury and monetary policy shocks. The red line shows the paths used as model inputs after a Treasury policy shock.

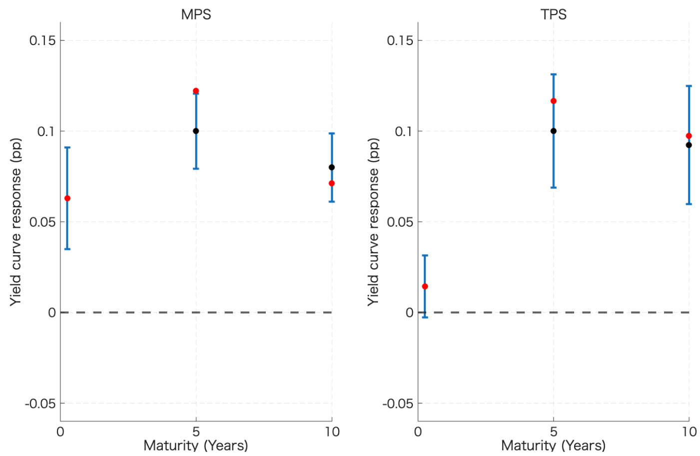


Figure D6: Yield curve responses to policy shocks

Note: Black dots are the empirical responses of Treasury rates to a Treasury policy shock (right graph) and monetary policy shock from Bauer and Swanson (2023) (left graph), while red dots are IRF-matching estimates. Vertical bars represent 90% heteroskedasticity-robust confidence intervals. The x-axis shows the maturity of each security, while the y-axis the percentage points change. Estimation sample is 1988:M1 - 2020:M2 for the monetary policy shock; 2003:M7 - 2025:M2 for the Treasury policy shock.

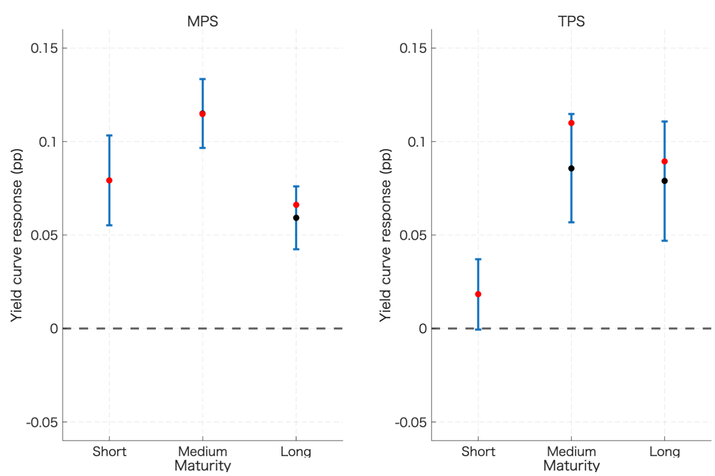


Figure D7: Alternative specification of the yield curve

Note: Black dots are the empirical responses of Treasury rates to a Treasury policy shock (right graph) and monetary policy shock from Bauer and Swanson (2023) (left graph), while red dots are IRF-matching estimates. Vertical bars represent 90% heteroskedasticity-robust confidence intervals. The x-axis shows the maturity of each security, while the y-axis the percentage points change. Estimation sample is 1988:M1 - 2020:M2 for the monetary policy shock; 2003:M7 - 2025:M2 for the Treasury policy shock. Empirical short-, medium-, and long-term responses are computed as averages of Treasury bills (3-, 6-months and 1-year), notes (2- and 5-year), and bonds (10- and 30-year), respectively.

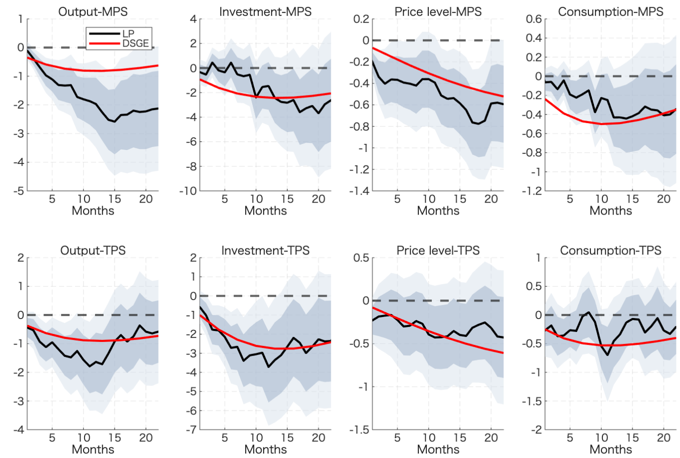


Figure D8: IRF-matching under alternative yield curve specification

Note: the figure compares empirical and model-predicted impulse responses to a a monetary policy shock (MPS) and a Treasury (TPS). The black solid line represents the point estimate of the empirical IRFs, with shaded gray areas representing 68% (dark) and 90% (light) heteroskedasticity confidence bands. The red solid line is the model-predicted impulse response. These impulse responses are obtained jointly with matching the alternative yield curve specification shown in Figure D7.

E. Fed's response to Treasury policy

This Appendix examines the response of the Federal Reserve to the Treasury's debt issuance policy. In the main text, we show that the Fed increases its holdings of both short- and long-term Treasury securities following a Treasury policy shock. Here, we show that this result is robust to the inclusion of alternative controls (Figure E1), and different sample periods (Figure E2). The point estimate for the policy rate changes when excluding deterministic controls. If anything, the response is even closer to zero, and then shows a mild decline. Moreover, even for this specification, the response is never statistically different from zero (at 68% confidence level) at any horizon.

Finally, for both the Fed's Treasury holdings and the policy rate, we verify the absence of pre-trends (Figure E3). The amount of long-term debt held by the Fed exhibits a mild downward trend, and therefore, if anything, it should drive our results in the opposite direction. For the policy rate and the amount of long-term Treasury holdings, there is no visible pre-trend.

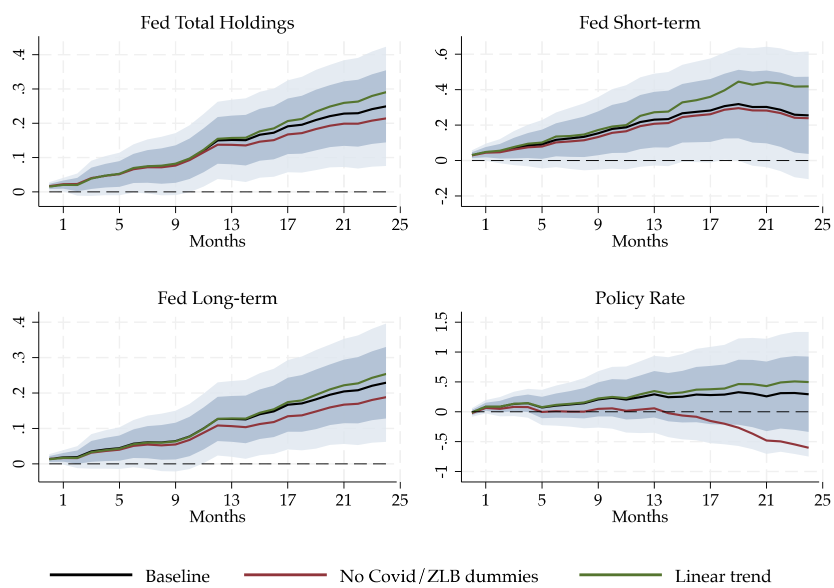


Figure E1: Different controls for Fed's response

Note: this figure checks the sensitivity of Figure 9 with respect to different controls. The lines correspond to point estimates.

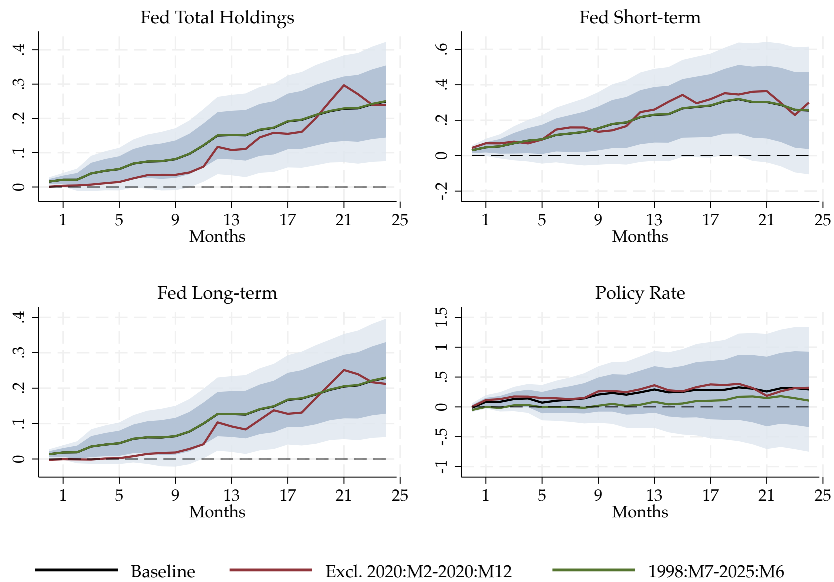


Figure E2: Different samples for Fed's policy variables

Note: this figure checks the sensitivity of Figure 9 with respect to different sample periods. The lines correspond to point estimates.

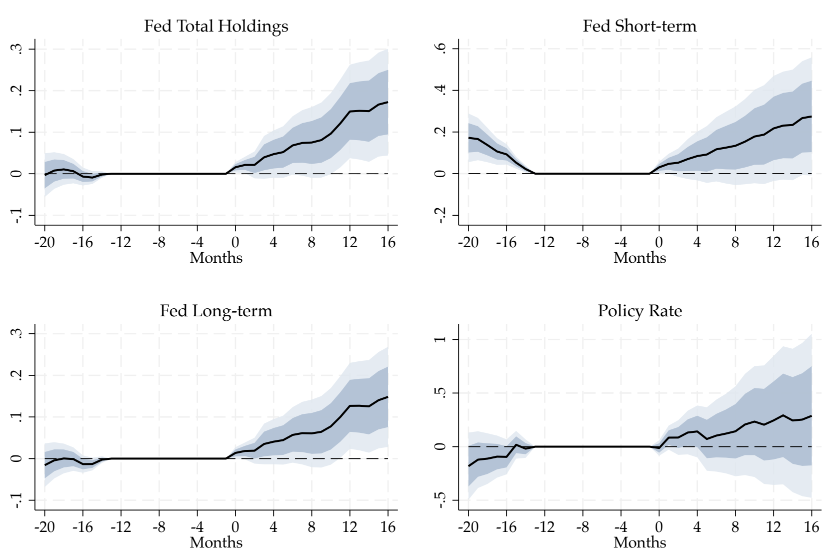


Figure E3: Pre-trends in the Fed's policy variables

Note: this figure checks the pre-trend for Figure 9.

Outliers. Figure E4 shows the time series of the Fed's short- and long-term Treasury holdings. Both series display substantial volatility over our sample period. For this reason, we explore the conditional correlation between the Treasury policy shock and the Fed's short- and long-term Treasury holdings in Figures E5 and E6. As one can see, two periods show the largest numbers of this conditional correlation: the Great Financial Crisis and the period at the end of 2019 and the first half of 2020, coinciding with the repo spike discussed in Section 5.

To assess the extent to which our results are driven by extreme observations, we perform two exercises. First, we winsorize these variables at the 1, 2, and 5 percent levels. Figure E7 shows that results are largely unaffected by this variable transformation. Second, we explore how results change when excluding these two episodes from our sample. Figure E8 shows that excluding either episode does not alter our results substantially.

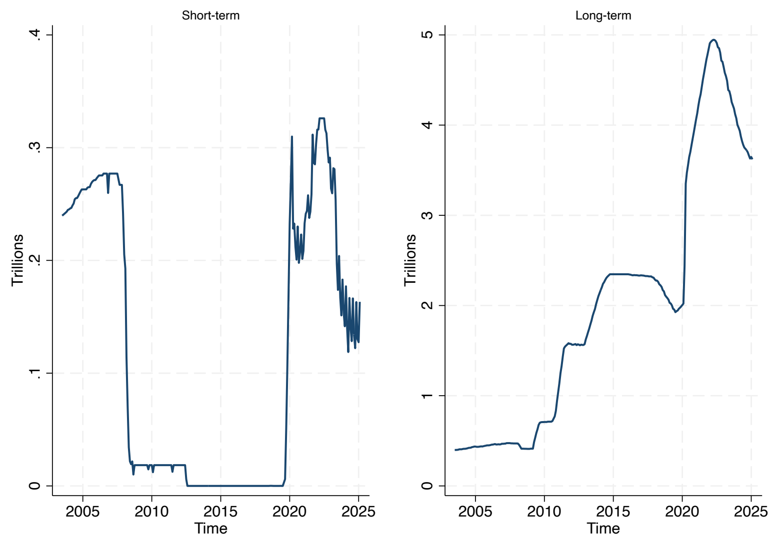


Figure E4: Evolution over time of the Fed's Treasury holdings

Note: this figure shows the evolution over time of the Fed's Treasury holdings. The left panel shows the Fed's holdings of short-term debt (with maturity of one year or lower); the right panel shows long-term debt (maturity of two years or longer). The x-axis shows years, while the y-axis shows the quantity in trillions of U.S. dollars.

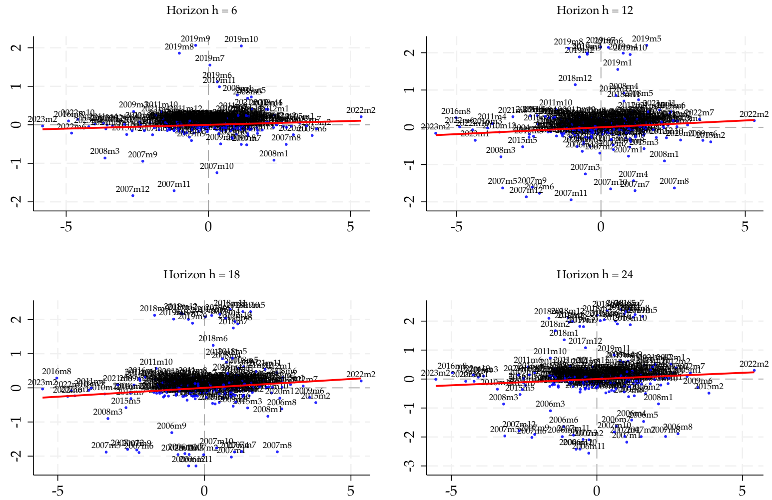


Figure E5: Conditional correlation of shock and short-term Treasury holdings by the Fed

Note: this figure computes the conditional correlation between the Treasury policy shocks and the Fed's response of short-term Treasury holdings. The x-axis shows the residual of the Treasury policy shock after we control for the regressors used in the baseline estimation (equation (9)); the y-axis shows the residual of the Fed's short-term Treasury holdings. Every dot represents a month, and the red line is the fitted line. Each graph corresponds to a different horizon h of the local projection.

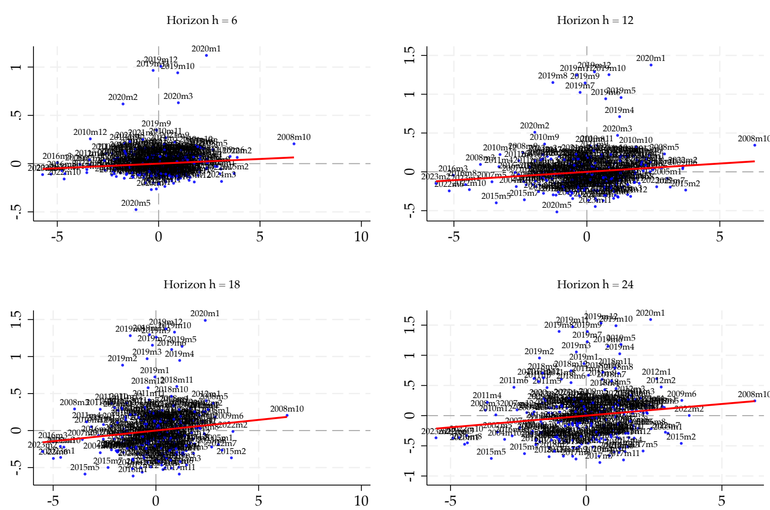


Figure E6: Conditional correlation of shock and long-term Treasury holdings by the Fed

Note: this figure computes the conditional correlation between the Treasury policy shocks and the Fed's response of long-term Treasury holdings. The x-axis shows the residual of the Treasury policy shock after we control for the regressors used in the baseline estimation (equation (9)); the y-axis shows the residual of the Fed's long-term Treasury holdings. Every dot represents a month, and the red line is the fitted line. Each graph corresponds to a different horizon h of the local projection.

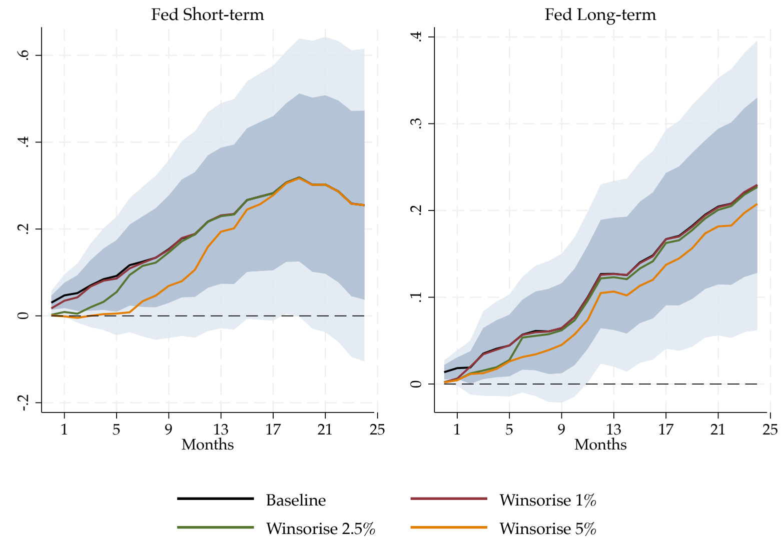


Figure E7: Winsorizing the Fed's Treasury holdings variables

Note: this figure checks the sensitivty of the responses of the Fed's short- and long-term Treasury holdings with respect to outliers. "Winsorise 1%" means replacing values below the 0.5th percentile with the 0.5th-percentile value, and replacing values above the 99.5th percentile with the 99.5th-percentile value.

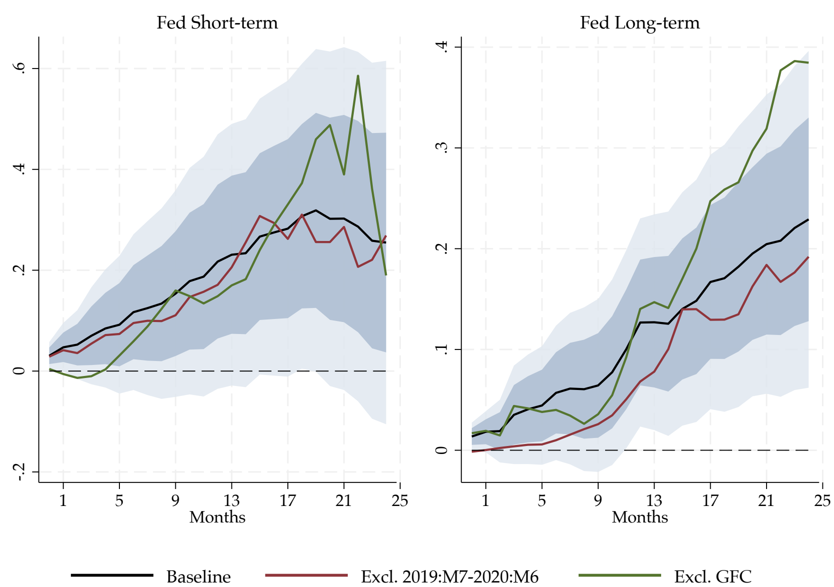


Figure E8: Excluding important periods

Note: this figure checks the sensitivty of the responses of the Fed's short- and long-term Treasury holdings with respect to excluding the months related to the repo spike and the start of Covid, when the Fed's balance sheet response was large (2019:M7 to 2020:M6); to excluding the Great Financial Crisis (2007:M12 to 2009:M6); to excluding both episodes.

F. Anecdotal evidence

In this section, we show the evolution of short- and long-term debt issuance in 2019. As shown in Figure F1, while the growth rate of long-term debt remained stable throughout the year, short-term debt issuance spiked in August. This large and unexpected increase in supply surprised markets and contributed to a sharp rise in repo rates, driven by the difficulty primary dealers faced in absorbing the volume of short-term debt issued.

This development forced the Federal Reserve to intervene in the short-term Treasury market to maintain control of its operating target. The response of the Fed is visible in Figure F2. The Fed dramatically increased its holdings of U.S. Treasury bills in response to the liquidty crisis.

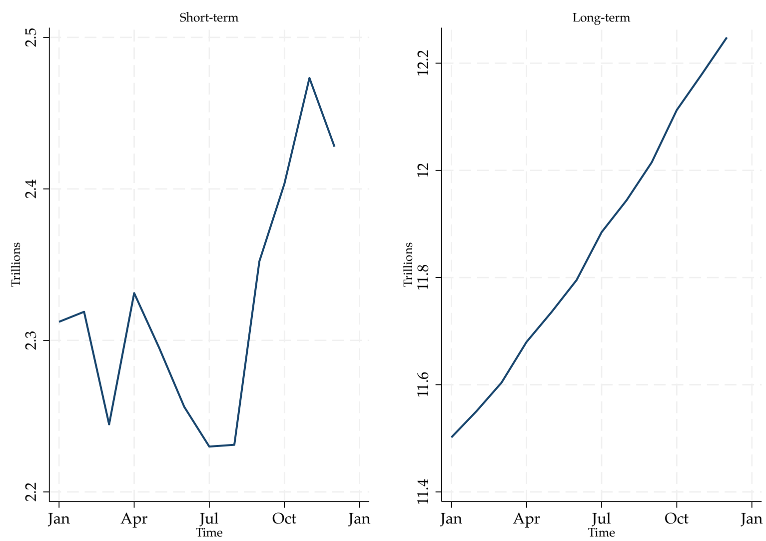


Figure F1: Short and long-term debt in 2019

Note: this figure shows the evolution over time of total debt in 2019. The left panel shows the short-term debt (with maturity of one year or lower); the right panel shows long-term debt (maturity of two years or longer).

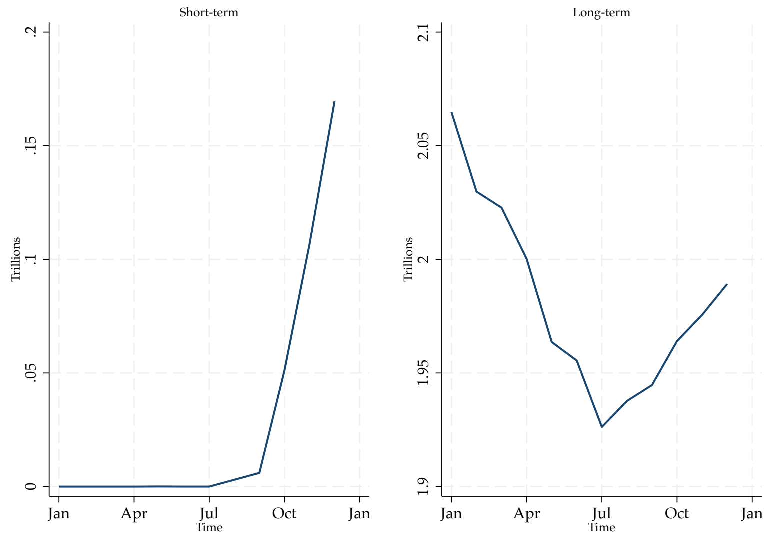


Figure F2: Short- and long-term Treasury holdings by the Fed in 2019

Note: this figure shows the evolution over time of Treasury holdings by the Fed in 2019. The left panel shows the short-term debt (with maturity of one year or lower); the right panel shows long-term debt (maturity of two years or longer).

References Appendix

Baker, Scott R, Bloom, Nicholas, and Davis, Steven J (2016). “Measuring economic policy uncertainty”. *The quarterly journal of economics* 131.4, pp. 1593–1636.

Barsky, Robert B and Sims, Eric R (2011). “News shocks and business cycles”. *Journal of monetary Economics* 58.3, pp. 273–289.

Bassett, William F, Chosak, Mary Beth, Driscoll, John C, and Zakrajšek, Egon (2014). “Changes in bank lending standards and the macroeconomy”. *Journal of Monetary Economics* 62, pp. 23–40.

Basu, Susanto, Fernald, John G, and Kimball, Miles S (2006). “Are technology improvements contractionary?” *American Economic Review* 96.5, pp. 1418–1448.

Bauer, Michael and Chernov, Mikhail (2024). “Interest rate skewness and biased beliefs”. *The Journal of Finance* 79.1, pp. 173–217.

Bauer, Michael D and Swanson, Eric T (2023). “A reassessment of monetary policy surprises and high-frequency identification”. *NBER Macroeconomics Annual* 37.1, pp. 87–155.

Beaudry, Paul and Portier, Franck (2014). “News-driven business cycles: Insights and challenges”. *Journal of Economic Literature* 52.4, pp. 993–1074.

Bi, Huixin, Phillot, Maxime, and Zubairy, Sarah (2025). “Treasury Supply Shocks: Propagation Through Debt Expansion and Maturity Adjustment”. *Working Paper*.

Bloom, Nicholas (2009). “The impact of uncertainty shocks”. *econometrica* 77.3, pp. 623–685.

Caldara, Dario, Cavallo, Michele, and Iacoviello, Matteo (2019). “Oil price elasticities and oil price fluctuations”. *Journal of Monetary Economics* 103, pp. 1–20.

Christiano, Lawrence J, Eichenbaum, Martin, and Evans, Charles L (2005). “Nominal rigidities and the dynamic effects of a shock to monetary policy”. *Journal of political Economy* 113.1, pp. 1–45.

Cloyne, James, Ferreira, Clodomiro, Froemel, Maren, and Surico, Paolo (2023). “Monetary Policy, Corporate Finance, and Investment”. *Journal of the European Economic Association* 21.6, pp. 2586–2634.

Droste, Michael, Gorodnichenko, Yuriy, and Ray, Walker (2024). “Unbundling quantitative easing: Taking a cue from treasury auctions”. *Journal of Political Economy* 132.9, pp. 3115–3172.

Fisher, Jonas DM and Peters, Ryan (2010). “Using stock returns to identify government spending shocks”. *The Economic Journal* 120.544, pp. 414–436.

Gertler, Mark and Karadi, Peter (2015a). "Monetary policy surprises, credit costs, and economic activity". *American Economic Journal: Macroeconomics* 7.1, pp. 44–76.

— (2015b). "Monetary policy surprises, credit costs, and economic activity". *American Economic Journal: Macroeconomics* 7.1, pp. 44–76.

Gilchrist, Simon and Zakrajsek, Egon (2012). "Credit Spreads and Business Cycle Fluctuations". *American Economic Review*.

Greenwood, Robin, Hanson, Samuel, Rudolph, Joshua S, and Summers, Lawrence H (2014). "Government debt management at the zero lower bound".

Hamilton, James D (2003). "What is an oil shock?" *Journal of econometrics* 113.2, pp. 363–398.

Jarociński, Marek and Karadi, Peter (2020). "Deconstructing monetary policy surprises—the role of information shocks". *American Economic Journal: Macroeconomics* 12.2, pp. 1–43.

Känzig, Diego R (2021). "The macroeconomic effects of oil supply news: Evidence from OPEC announcements". *American Economic Review* 111.4, pp. 1092–1125.

Kilian, Lutz (2008). "Exogenous oil supply shocks: how big are they and how much do they matter for the US economy?" *The review of economics and statistics* 90.2, pp. 216–240.

— (2009). "Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market". *American economic review* 99.3, pp. 1053–1069.

Kimball, Miles S (1995). *The quantitative analytics of the basic neomonetarist model*.

Kurmann, André and Otrok, Christopher (2013). "News shocks and the slope of the term structure of interest rates". *American Economic Review* 103.6, pp. 2612–2632.

Miranda-Agrippino, Silvia and Ricco, Giovanni (2021). "The transmission of monetary policy shocks". *American Economic Journal: Macroeconomics* 13.3, pp. 74–107.

Montiel Olea, José Luis and Plagborg-Møller, Mikkel (2021). "Local projection inference is simpler and more robust than you think". *Econometrica* 89.4, pp. 1789–1823.

Mustafi, Pal Utso (2025). "Deconstructing debt supply shocks using Treasury auction announcements". *Available at SSRN 4794463*.

Nakamura, Emi and Steinsson, Jón (2018). "High-frequency identification of monetary non-neutrality: the information effect". *The Quarterly Journal of Economics* 133.3, pp. 1283–1330.

Plagborg-Møller, Mikkel and Wolf, Christian K (2021). "Local projections and VARs estimate the same impulse responses". *Econometrica* 89.2, pp. 955–980.

Ramey, Valerie A (2016). "Macroeconomic shocks and their propagation". *Handbook of macroeconomics* 2, pp. 71–162.

Ramey, Valerie A and Zubairy, Sarah (2018). “Government spending multipliers in good times and in bad: evidence from US historical data”. *Journal of political economy* 126.2, pp. 850–901.

Ray, Walker, Droste, Michael, and Gorodnichenko, Yuriy (2024). “Unbundling quantitative easing: Taking a cue from treasury auctions”. *Journal of Political Economy* 132.9, pp. 3115–3172.

Romer, Christina D and Romer, David H (2010). “The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks”. *American economic review* 100.3, pp. 763–801.

Smets, Frank and Wouters, Rafael (2007). “Shocks and frictions in US business cycles: A Bayesian DSGE approach”. *American economic review* 97.3, pp. 586–606.

Woodford, Michael (2001). “Fiscal Requirements for Price Stability”. *Journal of Money, Credit and Banking* 33.3, p. 669.

Wu, Jing Cynthia and Xia, Fan Dora (2016). “Measuring the macroeconomic impact of monetary policy at the zero lower bound”. *Journal of Money, Credit and Banking* 48.2-3, pp. 253–291.